Pit and Quarry

Published Every Other Wednesday for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metallic Minerals.

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Pit and Quarry

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OBSOLESCENCE

PROBABLY no single industry has contributed more to American commerce than the automotive industry. Not alone in supplying us with the means for rapid transportation has it been a benefactor. Rather, the benefit from that industry (which is of mushroom growth, comparatively speaking) has in large measure come from the example it has set for all manufacturing enterprise.

Being in possession of a product that almost instantly met with popular acclaim it faced the problem of mass production. And it perforce had to solve its own problem because there were no previous experiences or precedents upon which to draw for guidance. Large scale production was a thing of immediate necessity. Not being able to produce automobiles in the demanded quantity with existing machinery and methods it became a part of the work of automotive engineers to devise new machines and strange methods that would give the required production. Machines and material handling equipment had to be produced "over night" as it were.

This was gambling of the highest order. Without precedent who was to tell whether the theoretical methods and untried machinery would produce? If they did—well and good. If they did not—just so much money, energy, thought and precious time had been wasted.

That the automotive engineer has succeeded is attested to by 21 million cars, 140,000 miles of improved highways, the present eminence of the industry's position and the worried expressions of railway officials. But in achieving his success the automotive engineer has contributed incalculably to all phases of American commerce, since adaptations of their machines and methods have found their way into mills and factories of every sort. Industry as a whole has learned more about mass production from the 36-year-old automotive trade than from any other single source.

Additionally, the success of the automobile maker is undeniable, unalterable, irrevocable proof of the value of inter-industry communication, co-operation and confidence. The sand and gravel producer of today who refuses to permit another producer's representative to visit and inspect his plant under the delusion that the visitor might gain knowledge of some "secret" process or individual method, is still living in the days of Harrison and has completely blinded himself to the progress that has been others by a policy diametrically opposed to his own. Anyone under the sun can visit and inspect Henry Ford's plants and, all things being equal, may even take pictures or exhaustive notes of particular processes. The same applies to every other large automotive plant. Has this giving away of "secret" processes or disclosure of individual methods ruined Ford or reduced the standing of the industry? Not perceptibly.

But there is an even greater lesson to be learned from the manufacturer of automobiles. As beneficial as their mechanical contributions have been—as far reaching as has been the rapid transportation provided—as powerful as has been the lesson of inter-company cooperation—there remains yet a greater, but frequently overlooked lesson—that which has to do with obsolescence.

Practically speaking, the automotive industry is only 30 years old. Yet in that time the methods by which automobiles are produced have changed completely — more than four times. Changing methods invariably means changing machinery. Does this mean anything to the non-metallic mineral man? Would it be considered possible to set up in business under the knowledge that it was going to be necessary to scrap and completely re-equip the entire plant every six or seven years? Any producer entering upon such a 30 year career would hesitate. And perhaps rightly so. But that is exactly what the automobile maker has had to do. If we of the sand and gravel trade are bothered over the problems of obsolescence (and they are growing ever more insistent day by day) we can learn much from the Detroiters.

It was only a few years ago that the frames for automobiles were made in several pieces that were riveted and bolted together. Today, a chassis frame is stamped out of one large piece of metal, then shaped to suit. Back in the old Prest-O-Lite days the engine was cast in several parts—a cylinder at a time—then assembled. Now the entire power plant—4, 6 or 8 cylinders—is cast en bloc. Transmissions have undergone three complete changes since the first of the 1900's. Some of these alterations in design and methods lasted only a short time. Refinements followed on the heels of improvements—and each change involved the scrapping of machinery and methods long before they wore out. In the motor industry machine upon

machine has been junked and replaced before even a bearing became worn enough to warrant replacement.

For the members of our industry who still grimly hang on to methods and machinery now 50 years old—can this recital of facts mean anything?

Not so long ago I visited a good sized plant in Iowa—there to find several screaming bearings of the babbitted type. The condition I found had been continuing for ten years. All that time the bearings had screamed for oil or better alignment. All that time coal had been thrown into the maw of the fire box only to have its steam power wasted in screams and needless friction. All that time, a better type of bearing (ball, roller, tapered, or whatnot) was available at a cost in no way approximating the cost of wasted coal alone.

In another midwestern plant I found in use the same dinkies pulling material to the crusher that had been installed a quarter century before. From the condition of the track and engine one might assume they had started their coal consuming when Bryan was advocating his 16 to 1 policy and the Joe Cannon stogie was the national emblem.

At this same plant the hammer type crusher was jogging along leisurely at a slow rate when with 10 per cent more power, *no more* men, and a simple change in power transmission equipment it could have been speeded up and made to produce 60 per cent more. And the owners were seriously contemplating the installation of another crusher!

Industry in general does not need more plants. We have more than enough now. Excess productivity is one of our biggest problems. This, however, does not mean we do not need more machines. Indeed, we have great need for re-equipment without end all the way from steam shovels to belt conveyors. And frankly, we would have the needed and much improved equipment if more of us were of the minds of automobile manufacturers.

Not all quarries are in a deplorable condition by any manner of means. Many of our present-day plants are constantly installing new and improved equipment—and gaining thereby. But let some car manufacturer equip his plant with machinery of a type that graces some of our plants and that manufacturer, in the highly competitive automobile industry, would promptly go into bankruptcy.

Today is not yesterday. 1928 is not 1898. The degree of efficiency of any machine cannot be determined by its ability to run. The only possible way to determine whether or not a machine is a money-making asset is to compare its output and cost with the improved machines now available.

Let us assume, for instance, that a plant generates its own electric power and that its boiler plant is burning mine run. This plant was installed, we will assume, in 1920. Boiler plant equipment should last 20 years. With proper care it will do even better. Does that mean that this plant should be kept in operation until 1940? Not at all. Let some manufacturer produce and prove he has equipment that will lift the level of boiler plant efficiency 15 per cent—and the old plant promptly becomes too costly to operate. In the interest of what might be done, the 8-year-old equipment (far from being worn out) must be scrapped and the improved equipment installed.

Suppose, for instance, some plant uses ten million gallons of water a day. All that water must be pumped—the pumps operated by steam. Regardless of when or at what cost those pumps were installed, if they cannot pump the water as rapidly or cheaply as a new and improved pump—replacement is necessary in the interest of economy and efficiency.

Obsolescence, in meaning, is a big word. It is far bigger than the old and now nearly obsolete "amortization." It is becoming increasingly difficult—quite impossible in fact—to predetermine the rate of speed at which costs may be charged off. With the constantly enlarging scope of automatization—the rapid rise of far-reaching improvements brought about by engineers from every field of endeavor—we find it increasingly necessary to buy equipment solely on the basis of economic necessity. To buy machinery or adopt methods on the basis of what they will produce in a given length of time is a system that died with the passing of the kerosene lantern. This is a dynamic age. Nothing today can be static and long exist. If, out of necessity to produce more or effect savings today, it becomes necessary to buy certain equipment, that purchase should be made. If, however, it becomes necessary to replace that new equipment to gain the advantages of a still further improved machine, that replacement must be made. Physical condition or degree of wear cannot enter into purchasing considerations today.

Producers have need to learn what the car manufacturer learned 20 years ago—that a machine or method is efficient only so long as there is available nothing better.

APRIL CEMENT STATISTICS

THE ratio of the operations to the capacity of the American Portland cement industry during the month of April was 70 per cent, according to figures released by the Bureau of Mines of the Department of Commerce. During the month 13,468,000 barrels were produced, 13,307,000 barrels were shipped, and there were in stocks on hand at the end of the month 27,605,000 barrels. Production in April, 1928, was 4.1 per cent less, and shipments about 7.3 per cent less, than in April, 1927. Stocks at the mills were 16.7 per cent higher than a year ago.

MEN OF THE INDUSTRY

The portraits printed on this page in each number of PIT and QUARRY are taken from our files and their selection is without significance as to current events or as to the position of the individual in the industry.

Gordon Willis

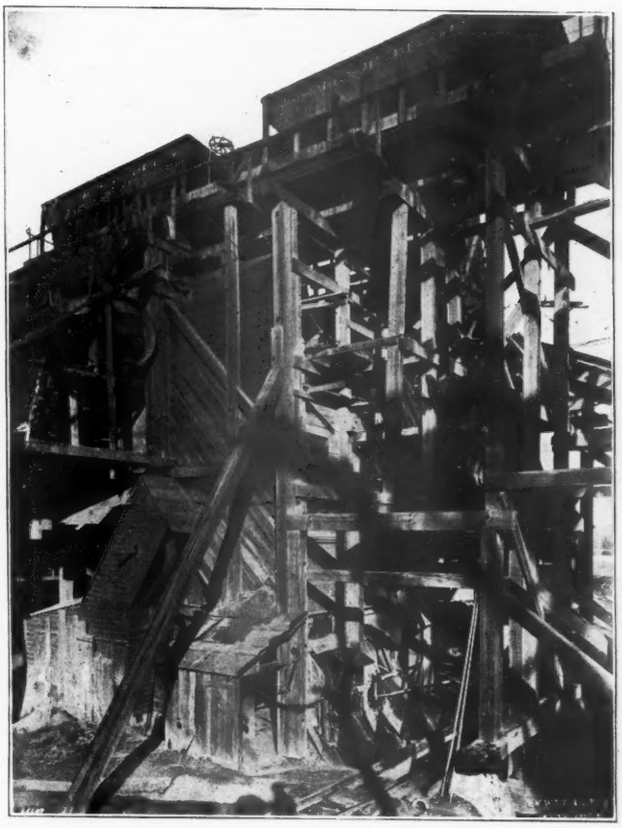
Mr. Willis is President of the
Peerless White Lime Company of
St. Louis, Mo.

LARGEST SAND AND GRAVEL PRODUCER HAS FINEST PERSONNEL MANAGEMENT SYSTEM

By F. A. Westbrook

NOT so long ago we used to see newspaper accounts of accidents due to the reckless riding of bicycle "scorchers" and pedestrians were warned to be on their guard. To-day, anyone slow enough to be run over by anything slower than a "Packard" would be "dead" before being hit. Similarly, the idea of "safety first," group insurance and what we now term personnel management or human engineering in industry were looked upon as liable to be carried a bit too far. While every conscientious industrial executive could not but feel that the welfare of his employees must receive consideration, he formerly seemed to think that to go as far as is now taken as a matter of mere good management was little short of what we would today stigmatize as "red." Thus do points of view change.

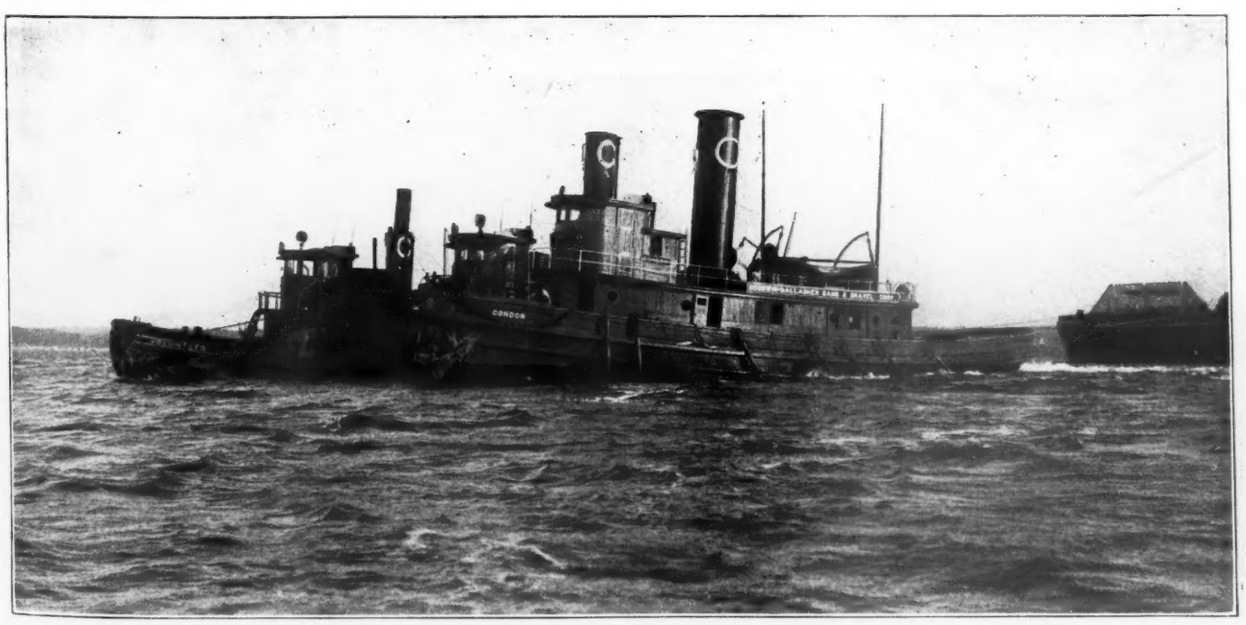
Of course in the smaller projects where there are only a few men and where the owner is in close contact with them these matters receive at least some attention in the natural course of events, although in very many cases without intelligent analysis. In large companies good personnel management calls for a definite policy on the part of the executives or it will go by default and under modern conditions good personnel management is an essential to success. This is as true in the non-metallic mineral industries as in any others.



Unloading at Plant to Convey to Washer

It is, therefore, perfectly logical that the Goodwin-Gallagher Sand & Gravel Corp., probably the largest producer in its line in the world, should have taken the problem of personnel management very seriously, with very interesting and important results.

In a previous issue of Pit and Quarry the mechanical part of this company's plant was de-



Towing Barges on Long Island Sound

scribed in some detail. It is now proposed to tell about the equally, if not more, important human side of the undertaking.

The operations of the Goodwin-Gallagher Corp. may be divided into three sections, namely: the sand and gravel production at Port Washington, Long Island, transportation by means of the Company's own fleet of barges and tugboats, and the New York office which covers selling, dispatching, purchasing of supplies and all clerical work. In all there are about 350 plant employees, 250 lighterage men, 75 to 100 shipyard men and about 20 in the New York office.

Employment

Applications for employment in the transportation department are handled at the New York office; those for the plant, by the plant superintendent at Port Washington. All applicants fill in the form herewith which is kept on file and subsequent information as to promotion, conduct, reasons and date of dismissal are entered thereon:

Name .....
Address .....
Age .....
Nearest Relative.....
Address .....
Kind of Work.....
Remarks .....
Nationality .....
Relationship .....
Entered Service.....
.....
.....
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Housing

Port Washington being a comparatively small residential suburban town and the gravel pits being, furthermore, some distance out, it is necessary to provide quarters and commissary for a good many of the men.

The commissary buildings are located at the south end of the plant and consist of sleeping quarters, main dining hall, recreation room, mechanics dining room, laundry, and showers. Approximately 200 men can be taken care of. The sleeping quarters vary from large bunk houses down to three and four room houses holding groups of less than a dozen and there is also a house laid out entirely with two berth rooms at a slight increase in price.

There is a large recreation room equipped with radio, piano, pool tables and a small store for cigars, etc.

The kitchen is exceptionally large and light and is equipped with the latest culinary devices.

In winter, boxing and wrestling bouts between the chosen representatives of the various departments excite great partisanship and the various meetings are as crowded as they are jolly. Professional entertainers from New York help the evening along with dance, song and story. So that the gentler sex may not feel neglected a dance is staged every now and then in the village of Port Washington and results in a crowded hall each time.

In the summer the athletic field is used by the baseball team and the famous Bar Beach being partly on the Company's property is the refuge of all those who enjoy swimming. In addition to all this the harbor is famous for its fishing and in the season is black with the disciples of gentle Izaak's art.

Recreation

Besides the foregoing, recreation for the employees is provided for in several ways. In the first place there is the fire company. This is more or less of a club to which it is a special honor to belong. The fire fighting apparatus is housed in a

Making up the Tow of Barges

special building of its own of which the second story is devoted to club rooms. Of course there are frequent drills and a number of social activities center around it, such as dances and non-athletic games, ending with a real shore dinner. In the winter there is a bowling league with a real contest for a handsome silver cup donated by one of the Gallagher brothers. The games alternate between New York City and Port Washington and whichever division of the Company is acting as host prides itself on the entertainment furnished their guests.

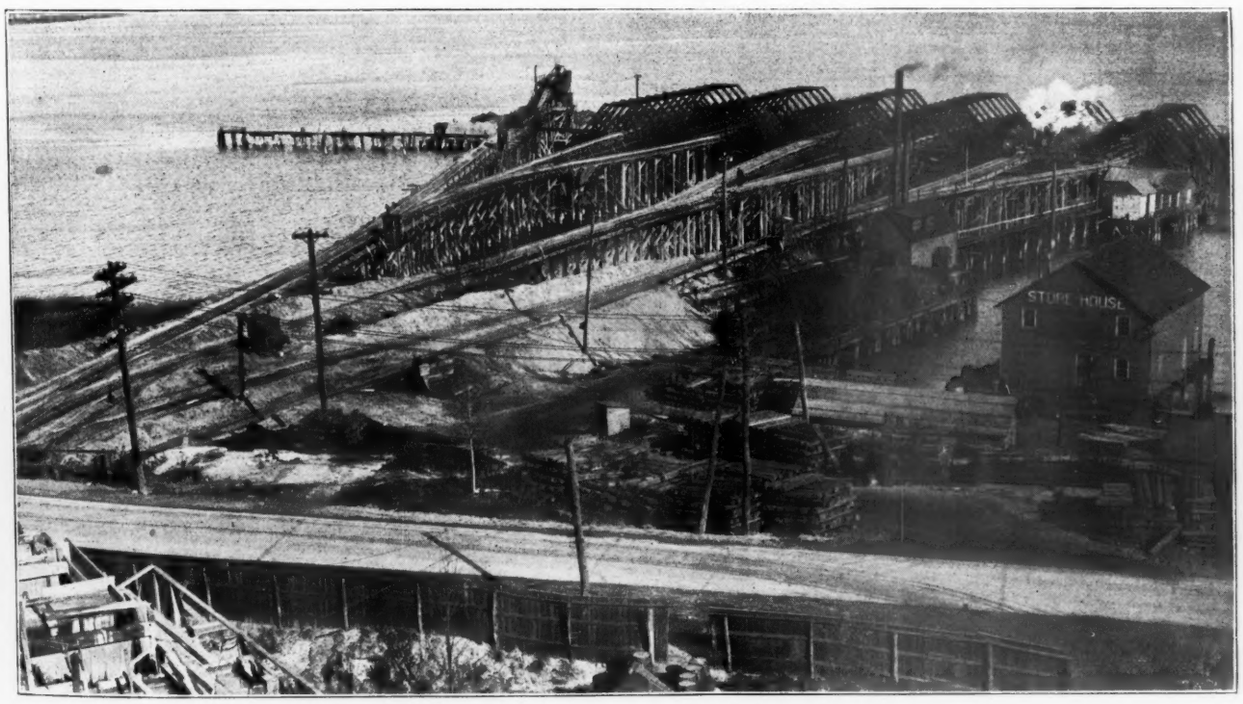
Insurance

Every foreman, shovel engineer, office employe, on employment becomes insured by the Company for $1000 which is increased by $250 for each subsequent year until a maximum of $5000 has been reached. The men may take out additional insurance in each instance at the same rate, if they care to pay for it themselves. The favor with which this has been received is quite remarkable. After two years, chauffeurs, locomotive engineers, cranemen, washer help, crusher help and pump men, electricians, blacksmiths and machinists are insured for the same amount. It is surprising to see how many of the men who at the beginning seem somewhat sceptical as to the benefits of insurance, rapidly change their views and become interested in the whole question of protection and regard their insurance policy as an item of great value.

Accident Prevention Work

Believing with the Committee on Safety and Production of the American Engineering Council that "Maximum productivity in industry is dependent upon the reduction of accidents to an irreducible minimum and the safe plant is the efficient plant," the Goodwin-Gallagher Sand & Gravel Corporation is doing everything possible to develop ways and means of abolishing accidents by the prevention of both the direct and remote causes thereof.

Dipper Excavating Bank



View of Tracks Leading to Barge Loading Tipple

Loading Barges from Overhead Track

The Safety Committee membership is composed of the entire supervisory staff, consisting of the plant executives: i.e., Manager, Superintendent; the foremen in charge of the various departments: i.e., mechanical, electrical, track, washers, etc.; and finally the pit and loading operations foreman. The plant office Manager is appointed permanent secretary of this Committee.

Temporary committees are formed monthly from the above group to concern themselves with the object in view, carefully observing and reporting at the monthly meeting any dangerous or hazardous condition existing about the plant. A temporary chairman is appointed monthly to direct the work of the foregoing committee.

On the day of the meeting the various committeemen report their observations. A discussion follows during which suggestions are offered to aid in removing the dangerous condition or equipment at once. The secretary makes note of any such condition or equipment so that the department head who has jurisdiction over same may be notified to remove or correct it. The representative of the insurance company is always present at these meetings to advise and encourage the men toward accident prevention. To sum up, the Committee and its meetings are a united effort to prevent accidents by coordinating all the resources and facilities of the plant in that direction.

These safety rallies are but the nucleus of the work which is further aided by such models of safety approach and application as: Picture shows carrying safety propaganda; extensive bulletin board service; pay envelope slips pertaining to such matters as safety at work and in the home and upon the highway; instructions to men to report every accident, no matter how minor in nature, to have same treated at once.

A modern, well equipped first aid room is maintained at a central location where immediate first aid is rendered by a man carefully instructed by the Company physician.

In conclusion, the results in safety among the employes have justified the efforts of the management both by added security of their plant and by the reduction to a minimum of the number and severity of injuries and possibilities of death.

While any management which embarks upon such a comprehensive system of personnel management must be primarily actuated by an altruistic point of view, the real desire to do the right thing by its employees, nevertheless it is a well known fact that it is a very good policy on which to conduct any industrial enterprise. Certain very beneficial and tangible results may be looked for. For instance in this company there is a good substantial number of dependable "old timers" who have been with the Company for years which form the nucleus of every good and efficient organization and without which none can hope to operate with continued success. In other words, the labor turnover has been extremely low for this kind of business.

Of course the question of loyalty and interest in the business is one of those intangible assets which cannot be estimated in dollars and cents but the importance of which cannot be over-estimated. This has been secured to a remarkable degree.

Plant Operation Described

The property of the Goodwin Gallagher Sand and Gravel Company covers over 850 acres and has a shore front of more than 4,000 feet on Hempstead Harbor. Along this water front is the shipyard of the company, which is in process of reconstruction. Tug boats and barges will be constructed in it and the docks, or slips, in which the barges are loaded directly from overhead track by having the bottom-dump gondola cars discharge directly into the barges, are located here. All shipments are made by water and delivered in New York or Northern New Jersey.

Material is taken from the pits by one Bucyrus and nine Marion steam shovels, of the following types: four Number 92, one 70, one 60, one 50 and two 20 Marions, and a Number 70 Bucyrus. These shovels load directly into specially constructed gondola cars of 30 ton capacity, manufactured by the Magor Car Company. Porter locomotives are used in the majority of cases to haul the 3 car trains to and from the pits. Material from the storage bins is taken by locomotives to the barges in similar cars.

There is an interesting detail about the locomotives which should be mentioned, namely, the use of Monel metal shields over the tops of the boilers to prevent rusting, as the washing is done with salt water and the locomotives pass under the bins where cars are loaded, which would corrode them if they were not protected.

There are two screening and washing plants, one of which is known as the Phoenix, or South plant, and the other as the North, or Gallagher plant, which take raw materials from two points. The Phoenix plant is being reconstructed and will be described only in part.

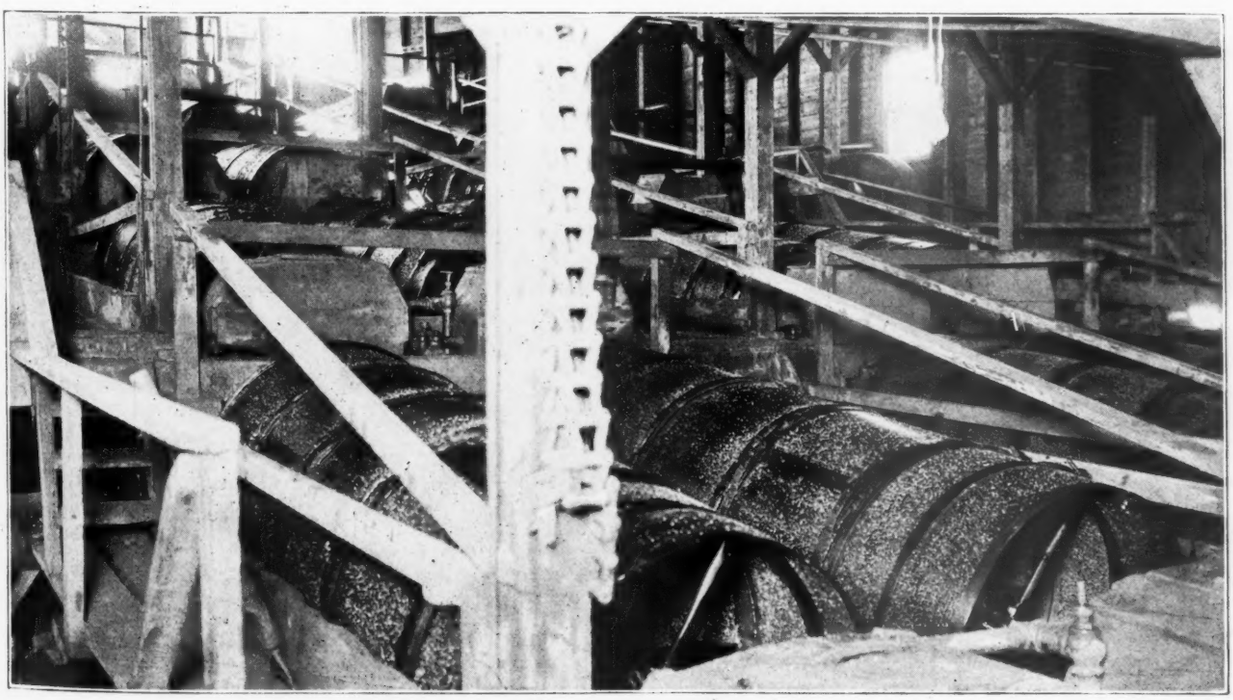
A new trestle is being erected so that trains of cars may be run to a large hopper which is conveniently situated but which is some distance away from the screens. The material from the pit is dumped into the hopper from the gondola cars and passes over an iron bar grizzly. The large stones slip off into a Farrel jaw crusher and the bulk of the material into bins. It is carried to the plant by means of two 36 inch belt conveyors on 400 foot centers which will use Robins idlers with Timken roller bearings. The drive, which is a double tandem, is to be driven by a 75 h. p. Westinghouse motor for each conveyor, using Falk reducing gears and couplings. One of the belts is being furnished by the New York Rubber Belting Company and the other by the Gutta Percha Company. From the crusher, there will be cross conveyors discharging on to the main conveyors.

These conveyors will feed into the top of the screening and washing house which contains twenty-four cylindrical rotary screens, 48 inches in diameter and 12 feet long, divided into four series of six each. The sand and water go to settling tanks

One of the Conveyors

and the commercial sand is drawn off into bins and other sizes deposited in their respective bins.

Dry sand is produced at the other end of this plant which is delivered in trains and dumped over bar grizzlies with 3 inch openings. The material which passes through the grizzlies is taken up in three parallel bucket elevators and passed over dry screens and the sand goes into bins. The rejects



Interior View of Screenhouse, Showing Screens

drop into a bin, at the foot of the central plant, from which it is fed by gravity into a Farrel jaw crusher. From here the crushed stone is raised by a conveyer to the screens.

As there is, at times, a surplus of the larger sizes at this plant, two crushers have been installed, near the washed gravel bins, which may be fed through chutes with such of these larger sizes as it is desirable to reduce. One of these machines is a Farrel jaw crusher and the other is a 16 by 42 Buchanan roll crusher. The crushed stone is taken by means of a belt conveyor back and discharged into a bin, hoisted and rescreened.

North, or Gallagher, Plant

The North, or Gallagher, plant has been completely rearranged and brought up to the best standards of modern practice and deserves a description. The material is brought in at two points from two working levels. The material from the upper level, is washed and that from the lower bank is screened as it comes from the pit without washing.

The screened, unwashed sand is delivered to the plant in trains of gondola cars. These are dumped over a central grizzly which removes the large stones. These slip off into an Acme 10½ D crusher and on to a 24 inch belt conveyor which discharges into the gravel conveyor, coming from other parts of the operation.

The sand and gravel which passes through the central grizzly is carried by five 36 inch conveyors, varying from 330 feet to 340 feet between centers, to a series of central stationary wire screens, placed at an angle of about 45 degrees, over large sand bins. The gravel is separated from the sand and slips down the incline to a 30 inch belt conveyor, 306 feet between centers, which discharges into the gravel conveyor from the upper bank hoppers to the washing plant. The railroad track passes under the dry sand bins so that cars may be backed under them, loaded and taken to the docks.

There is another conveyor associated with the dry sand bins which consists of two 24 inch belts, on 236 and 271 foot centers, which carry gravel to the mixer; from here, there is a 30 inch conveyor, 326 feet between centers; to a large overflow storage bin for mixed material. A railroad passes under the mixing bins for loading material on cars so it can be taken to the docks.

The material is brought from the upper bank of the pit, washed and dumped into hoppers over bar grizzlies which shunt the large stone into a Buchanan jaw crusher. These hoppers discharge on to two 36 inch belt conveyors, 294 and 312 feet between centers, which carry the mixture of sand and gravel to the top of the washer house.

At the hoppers, there is a third 36 inch belt, 332 feet between centers, which extends from them to a Buchanan roller crusher, located near the washed gravel bins. This belt is fed from several sources; first, from the jaw crusher, adjacent to the dry sand grizzlies; second, by the rejects from the dry sand stationary screens; third, by a 24 inch belt conveyor, 63 feet between centers, from the crusher at the Gallagher Hill hoppers; and fourth, from one of the latter hoppers where the accumulation of large sized gravel, small enough to pass through the grizzlies, is dumped.

This third conveyor carries the material to a series of three jaw crushers. A 24 by 64 inch Buchanan roll crusher is served by a 24 inch belt conveyor on 130 foot centers. As a general thing the roll crusher is the only machine used and the other three are held as reserve. The crushed stone is taken to the top of the washer house by a 30 inch conveyor.

The material, concentrated at the top of the washer house, is mixed with a stream of water and divides in two directions, into four lines of five revolving screens each. These are made of tank steel and are 48 inches in diameter by 12 feet long. Additional streams of water come in at each screen. The various sizes of gravel are deposited in their respective bins and the sand laden water is run into settling tanks. From the tanks, the sand is discharged into bins ready for loading. It is readily apparent that mechanical handling has been highly developed, when we consider that 20,000 tons a day, of 9 hours, is handled at this plant with 300 men.

Salt water from the harbor is used for washing and is supplied by four 8 inch Janesville and three 10 inch Worthington pumps, with a capacity of half a million gallons per nine hour day. The fresh water is obtained from a series of artesian wells using an 8 inch Dean triplex vertical pump. The drip lines are collected in a sump at each plant and together with the dirty water from the washers is lifted by two 8 inch Morris sand pumps with an 8 inch American Well pump for reserve.

There is a concrete store and office built by the company's men when there were slack periods in the regular work of production, which frequently occurs on account of adverse tides. This building was designed to fit the needs and, by careful arrangement of storage bins, the business of stock keep has been simplified.

At the present time, there are two forge shops and two machine shops divided between the two plants which can be consolidated, concentrate all repair and maintenance operations of a similar character at one point. In these shops there are three lathes, one shaper, one planer, three drill presses, boring mill, shear, punch, steam hammer, hydraulic press, turret lathe, oxy-acetylene and electric welding machines, various air compressors, sand blasting machine, and a spraying outfit for painting.

The company has one Reo and two Mack trucks. The Mack trucks are used for transporting materials about the plant and to and from Port Washington. The Reo is used to bring in the lighter materials from New York, where the company has a central receiving station. The very heavy materials are brought in on barges and lifted by the derrick lighter, Dorothy.

Electrical service has been handled in an unusual but practical way. Instead of having one outdoor transformer station where the voltage is stepped down for utilization and from which current is distributed throughout the plant, there are several such points. At each of these the transformers are placed in a Blaw-Knox steel-frame, metal sheathed house. The disconnecting switches, oil switches, high and low tension fuses have been installed in a neat manner. Disconnecting switches for the low tension feeders, which serve the various motors, or groups of motors, are mounted on racks.

There are dormitories for men without families and the laborers, and houses for the mechanics. All are equipped with electric light, steam heat and running water. The commissary feeds two hundred men at each meal. For this purpose there is a large dining hall and a smaller room for the mechanics. Recreational facilities in the form of pool tables and card playing are provided, together with a hospital building. The plant is rather isolated, which necessitates the workers being brought in from a distance; and , as there are no convenient housing facilities, it is necessary for the company to take care of its men in this manner.

The fire company has met with considerable success as only those workers are eligible who have proved their worth by length and quality of service. A house for the fire fighting apparatus has been provided, which has a club room as a social center for the old employees on the top floor. Fire drills are frequently held and some effective work has been done in fire fighting and prevention.

The general executive, sales, purchasing and despatching offices are at 21 East 40th Street, New York City. Despatching requires the services of two men who are kept busy maintaining a steady flow of materials to consumers and seeing that empty barges are not delayed in being returned to the plant. The fact that this has to be synchronized with the continually changing tides makes this work considerably more difficult.

People Spending More Money

The American people are spending money more freely this year than last. This is the conclusion drawn from a study of the country's checking transactions during the early months of the two years.

Debits to individual accounts in banks throughout the United States totaled $70,633,572,000 during March, 1928, it is shown by data collected by the Federal Reserve Board. This is approximately 21 per cent more than in the corresponding month of 1927. First quarter debits for 1928 are 16 per cent higher than in the previous year.

Check payments have increased steadily during 1928, it is also revealed. The March aggregate is 30 per cent greater than that of February, and 12 per cent over the figure for January.

The Federal Reserve Data are based upon reports received from banks in 141 cities of the United States. Banks in the Federal Reserve district centering in New York reported 65 per cent of the debits of the entire country, or $45,741,132,000. The Chicago district was second with $6,685,034,000, and the San Francisco district third with $4,059,378,000.

Special Highway Bill Passes

Passage by the Senate and House of the Public Land Bill, providing $3,500,000 a year for each of the fiscal years of 1929, 1930 and 1931, as a special highway fund for Federal-aid in eleven western states was announced recently by the American Motorists Association, which, with other motorist organizations, has supported the measure, which now goes to the President for his signature.

Purpose of the special fund, created by the measure, is to permit the construction of the gaps in the Federal-aid highway program which lie within those states largely owned by the Federal government and which under the Federal-aid program could not be completed for lack of funds, due to the inability of the states to match dollar for dollar the Federal government's appropriations.

In the state of Nevada, as an example, it is pointed out that 90 per cent of the entire domain is owned by the Federal government. In that state there are 1,398 miles of federal-aid highways which can be improved with this special fund and which will ultimately mean the linking up of the entire 186,000 miles of Federal approved highway system of the United States. The money is to be apportioned to each of the eleven states in the same ratio as the Federal-aid $75,000,000 annually appropriated. The measure does not limit the cost per mile which is done under the regular annual Federal-aid appropriation.

"Passage of the measure will mean much to the states and Federal government's highway construction programs and will meet with the unanimous approval of the millions of motorists of the country," J. Borton Weeks, President of the motoring organization declares. "It will mean the linking up of the East with the West with a continuous highway, thus permitting comfortable, clean and more economical travel from coast to coast."

QUANTITIES OF MATERIALS FOR CONCRETE

THE National Sand and Gravel Association, Incorporated, recently published its Bulletin 4 entitled "Tables of Quantities of Materials for Concrete," prepared by the engineering and research division. This bulletin presents tables from which quantities of cement, and fine and coarse aggregate per cubic yard of concrete may be determined for a wide range in proportions, consistency, and gradings of aggregate.

Comparison is made with other tables which have been published, pointing out that, although they take into account different sizes of fine and coarse aggregate, most of them make no allowances for differences in void content due to variations in grading, or are limited to designed proportions for different strengths of concrete.

The tables presented in this bulletin take into account the fundamental factors which affect the volume of concrete, the volume of solids in the cement and aggregate, and the volume of mixing water. The volume of concrete obviously is equal to the volume of solids in the aggregate, plus the solids in the cement, plus the quantity of mixing water, so long as there is a negligible quantity of unfilled voids or entrained air. Plastic, workable mixtures suitable for ordinary uses fulfill this condition.

Tables have been computed for 10 different mixtures, which include the arbitrary proportions commonly used, such as 1:2:3, 1:2:4, etc. Each table covers the range in quantity of mixing water likely to be required for proper conditions of workability, and a wide range in aggregates as typified by variations in void content resulting from shape and gradation of particles. The tables were prepared primarily for use in connection with proportions stated in terms of separated volumes of the cement and of the fine and coarse aggregate, but are equally applicable to proportions by weight and in terms of mixed aggregate.

Knowing the proportions by separated volume, weight or mixed volume, the quantity of mixing water (including the moisture in the aggregate), and the voids in the aggregate in the condition in which they are used, the quantities can be read directly from the tables. If the proportions are stated in terms of weight it is necessary to take into account the specific gravity and moisture content of the aggregate to determine what value of voids to use in applying the tables. As the value of voids used for this purpose is an abstract quantity bearing no necessary relationship to the actual void content of the aggregate, it was considered unnecessary to complicate the discussion by explaining the relationships involved. To simplify matters a table is presented giving the percentage of voids to be assumed for aggregates of different specific gravities and moisture contents. In applying the tables to proportions stated in terms of volume of mixed aggregate, reference should be made to the tables for which the sum of the volumes of fine and coarse aggregate is equal to the volume of mixed aggregate. In order to obtain accurate results correct assumptions of the void content are necessary, and the percentage of voids used must represent job conditions.

The determination of voids is a simple operation and may be done by several different methods without expensive equipment. The most accurate method requires a knowledge of the specific gravity of the aggregates in question, and of the weight per unit of volume and the moisture content under the conditions of the job. As determination of the specific gravity requires special apparatus it is not described, but a value of from 2.60 to 2.70 can be assumed without introducing a serious error.

The method used for determining the unit weight should duplicate as nearly as possible the method of measuring the aggregates for the concrete. Moisture content may be determined by drying a weighed sample and determining the loss in weight. When the specific gravity, unit weight and moisture content are known, the percentage of voids may be read directly from a table, or calculated from a formula, both of which are included in the bulletin. A method of determining the void content in both fine and coarse aggregates is also described.

The quantity of mixing water shown in the tables as gallons per sack of cement includes the moisture contained in the aggregates. A method is described by which the amount of mixing water can be readily calculated if the percentage of moisture in the aggregates, unit weights of the aggregates, and the proportions are known. In case this method is impracticable, a table may be used giving the approximate quantity of free water carried by average aggregates.

Typical problems and their answers are included, demonstrating and making clear the use of the tables, as well as a number of references to various books and bulletins giving more detailed information relative to the subject.

April Cement Statistics

The ratio of the operations to the capacity of the American Portland cement industry during the month of April was 70 per cent, according to figures released by the Bureau of Mines of the Department of Commerce. During the month 13,468,000 barrels were produced, 13,307,000 barrels were shipped, and there were in stocks on hand at the end of the month 27,605,000 barrels.

PROBLEMS OF HIGHWAY CONSTRUCTION

By Charles E. Grubb, County Engineer, Wilmington, Del.*

THE problems of highway construction are primarily engineering and economic in nature. Before actual construction is undertaken, a very thorough and careful analysis should be made of the traffic needs, present and prospective, the financial resources and the possible returns from an investment in highways for the territory. These returns should be measured by the probable influence of the improved transportation facilities upon the daily lives of the individuals of the area for their economic, civil and social advancement.

The responsibility for the development of highways should not be shifted from one jurisdiction to another merely for the purpose of shifting the financial burden or for political reasons. The committee feels that the increasing transportation needs of every territory can be better served if closer cooperation be firmly established.

In localities where traffic is light, it is evident that not only will the investment in one of the higher types of construction be unwarranted by the returns therefrom, but very likely roads of a moderate cost will serve traffic demands for a number of years. The decision as to choice of construction type is influenced by such variables as location, population, topography, soil, local materials, latitude, character and volume of traffic, available funds, resources and legislative restrictions. From a survey and painstaking studies, an estimate of the returns that a road or system of roads will net may be approximately determined and a program for construction, decided upon.

Many rural counties today are turning to the progressive or stage method of construction which has been attended by remarkable success in the state of North Carolina. By this plan, improved road service over the whole territory is provided from the beginning even though for a very large percentage of the mileage this includes only the shaping of the native road. Immediate benefits may thus be given to all portions of the county and a more general support of the construction program obtained. On the progressive type of roads, right-of-way should be secured sufficiently wide to provide a minimum of thirty feet between gutter and to admit of full width development on those so located as to indicate their future use as trunk lines.

Grade crossings, as far as practicable, should be eliminated either by relocation of highway or railroad or construction of a bridge providing for a separation of their grades. High curves should be banked to admit of the movement of traffic at a high rate of speed without danger of skidding.

*Abstract of Committee Report presented to the American Road Builders Congress.

Adequate drainage by suitable pipes, culverts and bridges should be provided in the same manner as desired for the final development without regard to the stage of construction and, as the community develops, the stage constructed roads can be improved approaching as the final result, a high type of hard surface road without loss of any step of the successive stages.

To avoid unnecessary inconvenience and reduce delays, the engineer should not only follow the construction but be ahead of it and direct its progress. His personal influence should be impressed upon the contract for the best speed and quality of work. The engineer and contractor should determine upon a working schedule, establishing dates for accomplishment of the different stages of the work showing possible completion well within the designated time.

As far as possible, testing of materials such as asphalts, tars and cement should be arranged for at the source by reliable testing engineers. This plan reduces hold-ups in the field pending tests and gives the assurance that sampling and testing will be performed in a standard and uniform manner. Field judgment of other materials should be checked by laboratory tests. In following the construction, the engineer should be assisted by competent inspectors, and he can facilitate inspection and improve results by underscoring the most important parts of specifications submitted his inspectors and by outlining particular items of the successive steps of the work for special attention.

Reports stating the progress of the various items of work, weather conditions, number of workmen on the job, equipment in operation, material received, material consumed and other pertinent information or remarks to permit the office to keep in touch with the contract, should be prepared and submitted by the inspectors daily to both the field engineer and the control office. On concrete work it is usual to require that the empty bags be counted and reported as a check against the yardage laid and the proportions or yield of the mix.

Current estimates to be prepared by the field engineer, including all work performed as may be determined from daily reports and field observation without accurate measurement, should be submitted and paid promptly at regular intervals. The final estimate should be compiled and paid immediately upon completion and acceptance of the work which permits contractors to discount bills and account for their operations in a better business manner, securing in turn for the county, lower quotations on subsequent contracts. Pavement guarantees for periods of time following completion are unwarranted if the work is constructed

under competent supervision and in accordance with well drawn specifications for a generally accepted standard construction.

In concluding the report, the committee emphasizes that compared to the vast mileage of roads untouched by construction of any character the present county activity and the widespread Federal aid and state construction might be considered as merely scratching the surface of the final highway development of our country. From the present undertakings, the impression is often gained that road building is keeping pace with other activities whereas just about enough miles of new pavement are being added each year on which to park end to end, the new automobiles purchased. We have a few hundred thousand miles of improved roads and millions of miles of roads suitable only for buggies and wagons.

Capital Yields $4,751,000,000

Capital invested in the principal business enterprises of the United States paid a return of approximately $4,751,000,000 in 1927, it is shown by an examination of data gathered by the U. S. Census Bureau. Nearly two-thirds of this amount, about $3,472,000,000, consisted of interest income; the remainder represented dividends.

Wealth produced by invested capital in this country, as represented by interest and dividend payments, increased steadily during the past decade, the Census Bureau figures show. In only one year since the war, the depression year of 1921, did the total return on capital fall below that of the preceding year.

The aggregate capital return in 1927 was $360,000,000 greater than in 1926 when $4,391,000,000 was paid, and more than double the amount in 1916 when payments were $2,135,000,000.

On a per capita basis the share of each resident of the United States in the 1927 interest and dividend earnings of the country amounted to approximately $40. In 1926 the per capita was $37, and in 1920 only $32.

Autos Number 23,127,315

Motor cars in operation in the United States now number 23,127,315 vehicles or one to each five persons in the country, according to the newest count to be made by the U. S. Bureau of Public Roads.

Passenger cars number 20,230,420, the Bureau reported. It is estimated that there are 27,000,000 families in the United States.

Motor trucks number 2,896,886 vehicles. In the last two years sales of trucks by manufacturers have increased faster than the sales of passenger cars.

The newest total of all motor vehicles indicates that in the last twelve months the number of automobiles in operation has increased about five per cent.

Motorists now are paying registration and license fees at the rate of about $301,000,000 a year, most of which funds are being expended to build and maintain highways.

Fire Damage in U. S.

Fire ravage in the United States is costing approximately $3.84 annually for each inhabitant of the country, it is shown by a study of loss data reported to the National Board of Fire Underwriters. Unreported losses, the board estimates, would add 25 per cent to this figure, increasing the annual property destruction by fire to $4.80 per capita.

Twenty-nine states, the reported data show, have smaller fire losses per person than the country at large, while in nineteen states the destruction is above the national average. Residents of Delaware suffer least from fire, it is revealed, sustaining an annual loss of only $1.55 per capita. New Mexico follows with $1.61. Next in rank are Colorado, $1.71, Wyoming $1.81 and Arizona $2.13.

California leads all other states in fire loss per inhabitant with an average of $6.25. Nevada ranks second with $6.05 for each resident, Massachusetts with $5.78 is third, Oregon $5.70 fourth and Florida $5.65 fifth.

America's annual fire devastation is greater than that of any other nation in the world. A large proportion of the conflagrations, it is claimed, are preventable by the exercise of proper care.

More than 27,000 Banks in U. S.

Banks serving the financial needs of the American people now number approximately 27,529. An enumeration made by Rand McNally & Company shows this number of financial institutions in operation in the United States as of January 1st. Concerns doing a strictly investment business are not included in the count.

Illinois leads all other states in the number of banks doing a business within its borders with a total of 1,841. Pennsylvania ranks second with 1,611. Iowa, third, has 15,000, Texas fourth, 1,493; Missouri fifth, 1,404. New York state is only sixth in the list, its banks number 1,254.

In the country as a whole there are approximately 189 banks with deposits of $40,000,000 or over each, it is shown. About 135 more have deposits between $25,000,000 and $40,000,000. In all, 6,595 banks have deposits of more than $1,000,000.

Chicago with 216 leads all cities in the number of its banking institutions. New York is second with 161. Philadelphia has 123, Brooklyn 67, St. Louis 57, and Detroit and Los Angeles 23 each.

EXCAVATING PEAT IN CALIFORNIA

MOST of the peat beds in California are formed by the tule roots, a reed-like growth. The scene pictured here is on the thirty-acre tract of peat land owned by E. E. King near Huntington Beach, California. The peat formation in this tract is about 18 feet deep, and the machinery employed in taking it out is a half-cat tractor with bias drag line, and operates much in the fashion of a steam shovel.

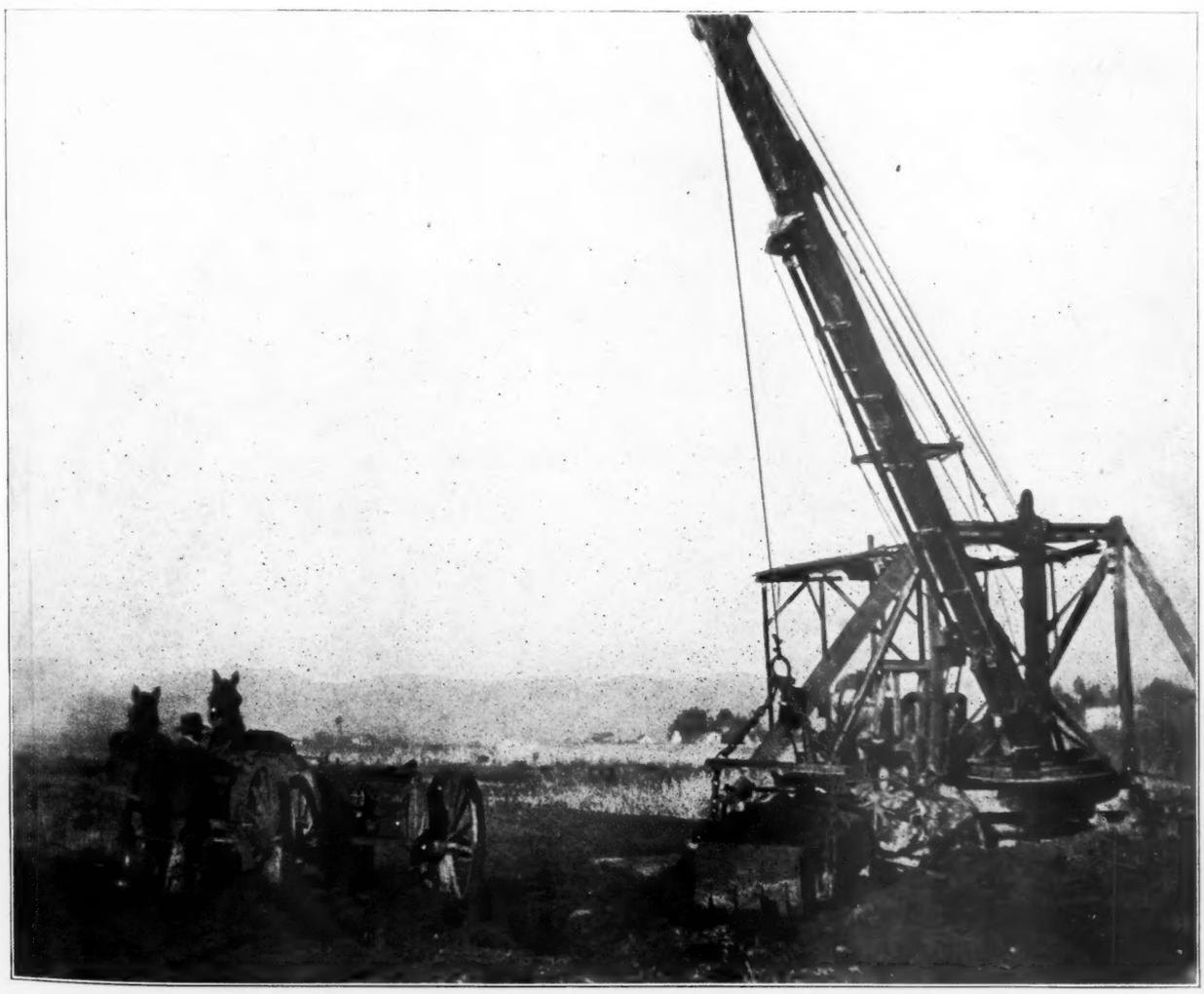
It is estimated that at least a thousand years was the length of time taken in the formation of the peat deposits, and the depth of them would seem to verify this.

The largest peat beds in the state are found near Stockton, where big yields of potatoes are sometimes raised through this agency.

On the tract of Mr. King, there is a mill for grinding the peat and a considerable demand for peat humus manufactured here has been established.

It would seem that the uses and limitations of peat in agriculture and horticulture are not very well known, for there are still many people who look on it as a fertilizer instead of a conditioner of the soil. Here on this tract emphasis is laid on the preparation of the peat. There must be, of course, a suitable bog free from injurious compounds such as alkali salts, mineral matter and noxious seeds. At this plant, the top soil is removed so as to exclude these seeds, and the bag itself seems satisfactory in its nature. "Fresh Peat," is not sold, but all taken from the ground is carefully aerated. The next thing to receive particular attention is the fineness of the grinding. Large chunks of peat stirred into the soil do not benefit it, and so the degree of fineness to which it is ground receives particular attention.

Much stress too is laid on the "natural" moisture content of the peat. It cannot be added to the soil in a fresh state with good results but yet must not dry out too much. The peat when excavated is laid out in long windrows to cure, and is turned and cared for by those experienced in the conserving of its best features. When peat is allowed to become



Excavating Peat from one of the Deposits in California

air dry it will not, even if moistened before application to the soil, reabsorb water, and lies as so much "dead matter" in the earth. Care is taken to store the prepared product so it will not lose this vital original moisture.

Nurserymen, landscape gardeners, and amateur flower growers are finding more uses for peat, and it is used extensively in preparing golf courses in

Showing Peat Drying and Storage

California. On of its chief advantages is that it will lie in the soil for several years, and continue to help it along when the soil is cultivated. It is claimed for the peat that it has 1¾ per cent nitrogen, one-half of one per cent of which is immediately available, and the remainder becomes active through cultivation of the soil and moisture.

Except in the case of the large yields of potatoes already mentioned, the use of peat in field crops has not seemed to be very satisfactory in California as yet, though it is believed that this is largely through ignorance of how to use it. As there are millions of "wet lands," a large portion of which are peat bogs or potential ones, it would seem that it should be made more useful.

Professor Alfred P. Dachnowski, of the Office of Soil Bacteriology at Washington, hints at many ways it can be utilized, both in composts with other fertilizers, and as an absorbent. Referring to the deodorizing absorbent properties of peat, he states his belief that the use of it with human sewage has not received the attention it deserves.

This use of it has been tried in Sweden and other European countries, he states, and the observation of tests extending over a number of years, and the results in the way of profitable returns have convinced many that this was a subject meriting more attention. He recommends peat to be used as a health protective measure where water flushing away of human waste cannot be practised. This is often the case on farms, and rural and out-of-the way districts.

An interesting use of peat was the subject of a short article in the Country Gentleman recently, where a contributor mentioned the fact that certain diseases attacked young chickens where brooded under intensive conditions, especially if they ran on the ground where chicks had been brooded in previous years. He states that a well filled brooder house soon becomes moist through the accumulations of droppings and the moisture given off from them.

He recounts that recent experiments with peat moss as a littter for chicks had somewhat startled poultry keepers by the fact that one can apparently put peat moss litter under the hover for young chicks and not remove it for eight or twelve weeks. He praises the peat highly for its ability to keep the house dry and discourage the cocidia, the chick's enemy, from multiplying. He recommends it being spread over the brooder house floor an inch thick, but no grain or mash is to be fed in it. It does not need to be removed until quite saturated with moisture and droppings. In this stage, no doubt, it would be good fertilizer.

Cement Accident Campaign Effective

Sixty-nine cement mills and quarries in the United States and Canada, out of a total of 151, finished the first quarter of 1928 without a lost time accident or fatality. These 69 plants form the basic membership of the Portland Cement Association's Trophy Club. To the mills going the entire year free from accident the association awards an eight ton concrete sculptored monument, modeled by the Art Institute of Chicago.

Twenty-nine more mills operated during the first quarter of 1928 free from accidents than during a similar period in 1927. On March 31, 1927, only 40 mills had completed three months minus accidents and were members of the Trophy Club.

"This remarkable showing in safety work points the way to even a better record in 1928 than we had in 1927," says W. M. Kinney, general manager of the association. "Last year ten mills went through the year without accident and if the present ratio is maintained for the next nine months we may well expect 18 or 19 mills to eliminate mishaps and fatalities this year."

During the first quarter of 1927 the cement industry suffered 395 lost time accidents and nine fatalities. The first three months of 1928 recorded 292 lost time accidents and eight fatalities. Lost time accidents decreased 26 per cent in the first quarter of 1928 over the similar period of 1927 which at that time was considered a record breaking achievement. There was an increase of 11 per cent in the number of mills reporting their accidents to the association in 1928, over 1927.

Comparing the first three months of 1928 with the first three months of 1926 shows a decrease of 271 accidents or 46 per cent. During this time the number of mills reporting increased over 21 per cent.

PRODUCTION OF BLAST FURNACE SLAGS FOR ALUMINA CEMENT MANUFACTURE

By T. L. Joseph
Supervising Engineer, Bureau of Mines, Minneapolis, Minn.

THE purpose of this article is to describe briefly the operation of a 6-ton blast furnace on a charge of bauxite, limestone, iron ore, and cast-iron turnings and to point out the bearing which smelting such a charge has upon the production of alumina cement. One object of the experiment, conducted by the Bureau of Mines in cooperation with the Aluminum Company of America, was to determine whether the so-called Pedersen process[3] can be applied to the blast furnace. This process consists of smelting a charge of bauxite, iron ore, and limestone, and results in two products. One is a slag containing about 50 per cent of Al_2O_3 and is intended for use in manufacturing aluminum, and the other is iron low in sulphur. Complete details of the test are published in other reports.[4]

Blast-furnace slag is now recognized as a satisfactory and economical raw material for making Portland cement. Wm. A. Forbes[5] has recently reported that in 1926 an important steel interest used well over 1 million tons of slag in producing about 2¼ million long tons of cement. This is equivalent to about ½ ton of slag for each ton of cement. Alumina cement can be made direct in the blast furnace. Its physical character would have to be changed by grinding, but no change in its chemical composition would be necessary.

Alumina Cements

This type of cement was of special value to the French army during the World War for construction of gun emplacements and roads. It is characterized by its high alumina content and high strength at early periods. Since the war interest has steadily increased in its application to general construction work in which time has economic importance. Raw materials and technical details connected with the manufacture of alumina cement and Portland cement differ markedly. Most of the alumina cement is made by secret or patented processes involving partial or complete fusion of the raw materials.

R. J. Anderson[6] has summarized the situation regarding this cement as follows:

"Much interest is being taken these days in the high early-strength aluminous cements, and these cements appear to have considerable future. Aluminous cements have been manufactured in France for some years, while the American-made product appeared on the market for the first time in 1924. They are also now being made in England. The high-alumina cements are made by the fusion of bauxite and limestone in an electric furnace or by clinkering in a rotary furnace. In France, these cements are termed 'ciment fondu' or 'ciment electrique.' They are valuable because of their quick-setting characteristics and their resistance to chemical attack, particularly to sea-water action. The use of aluminous cements ensures outlet for a considerable tonnage of the lower grades of bauxites which can not now be used for other purposes. A typical analysis of aluminous cement is 10 to 12 per cent silica, 40 to 45 per cent alumina, 35 to 40 per cent calcium oxide, and 15 to 20 per cent iron oxide. The interest in aluminous cement brings up an important question with regard to the future supplies of bauxite for this new industry. French production is now about 50,000,000 barrels per annum, equivalent to about 8,300,000 long tons, or about one-eighth of the total output of Portland cement. The world production of Portland cement is running at the rate of 420,000,000 barrels per annum, equivalent to 70,000,000 long tons. If 10 per cent of this were converted to aluminous cement, and there is ample scope for this production, the amount of bauxite required in making it would be about 3,500,000 tons. Thus, there may easily be caused an acute shortage of bauxite. French producers have, indeed, been pinched for supplies recently.

"Much has been written on the relative merits of high-alumina and Portland cements, but such matters are beyond the scope of this report."

Composition of Alumina Cements

In studying the cementing qualities of calcium aluminates P. H. Bates[7] has reported analyses of 8 clinkers made in a rotary kiln. In referring to his investigation he states:

"The ideal composition considered both from economy in cost of raw materials and general qualities of the cements produced therefrom would appear to be exhibited by cements No. 4 or 7."

The analyses (in per cent) of the clinkers cor-

[1] This article is not subject to copyright. Reprinting, with customary acknowledgement to the Bureau of Mines, will be welcomed.
[3] Mining Journal (London), Developing aluminum production in Norway: May 29, 1926, p. 440.
Norwegian Patent 43,415; French Patent 596,400; British Patent 232,930; Canadian Patent 269,220; Swedish Patent 115,356.
[4] Joseph, T. L., Kinney, S. P., and Wood, C. E., Production of High-Alumina Slags in the Blast Furnace; Am. Inst. Min. and Met. Eng. Tech. Paper 112, February meeting, 1928; Tech. Paper 425, Bureau of Mines (in press).
[5] Forbes, Wm. A., Technological problems of the steel industry: Year Book, Am. Iron and Steel Inst., 1927, p. 266.
[6] Anderson, R. J., The outlook for bauxite in 1926: Mining Journal (London), vol. 152-153, Jan. 16, 1926, p. 48.
[7] Bates, P. H., Cementing Qualities of the Calcium Aluminates: U. S. Bureau of Standards Technol. Paper 197, 1921, 27 pp.

responding to these two cements are as follows:

Cement No.	SiO_2	Al_2O_3	Fe_2O_3	CaO	MgO	Ig. loss
4	10.48	46.71	2.13	39.79	1.04	0.32
7	11.33	47.66	3.10	34.87	3.66	0.17

According to French specifications[8] alumina cements must contain not less than 30 per cent of Al_2O_3 and not more than 1 per cent of S. The sum of the CaO and MgO must not be greater than the sum of the SiO_2 plus Al_2O_3.

The following table gives further approximate analyses of alumina cements in per cent.

	SiO_2	$Al_2O_3+TiO_2$	Fe_2O_3	CaO	MgO	Insol.	Ig. loss
[1] [2]	8.68	41.53	7.1	40.96	0.69	3.49	...
[3]	12.0	40 to 60	10.0	less than 40	...	...	...
[4]	5.8	33.7	15.1	38.6	Trace	...	[5]2.4
[6]	10.0	40.0	10.0	40.0	...	...	...

Tests with a Six-Ton Blast Furnace

During a 3-week test about 70 tons of high-alumina slag were produced in an experimental blast furnace. The slag composition varied over a wide range during the test. The range of composition covered follows: SiO_2, 6 to 33 per cent; Al_2O_3, 18 to 53 per cent; CaO, 35 to 52 per cent; TiO_2, 1 to 2 per cent; FeO, 1 to 2 per cent; and S, about 0.5 per cent. Most of the 70 tons of slag made during the test was in the high-alumina range, the large change in composition being made during the transition from slag of about normal composition to high-alumina slag. The average composition (in per cent) for the whole test is as follows:

SiO_2	Al_2O_3	FeO	CaO	MgO	TiO_2	S
7.88	43.44	1.17	44.11	Trace	2.07	0.72

During the latter part of the test the Al_2O_3 in charge was increased. An average analysis (in per cent) of slag made during this period follows:

SiO_2	Al_2O_3	FeO	CaO	MgO	TiO_2	S
8.46	47.24	1.44	39.64	Trace	2.12	0.70

The production of this slag offered no difficulty. Blast pressure, an indicator of general furnace operation, was uniformly low. Only moderate blast temperatures were obtained, the average for the period being 885 degrees F. There seems little doubt as to the feasibility of operating a blast furnace on a charge of bauxite, limestone and iron ore, so as to produce a substantial amount of iron and a slag which falls within the range of composition of alumina cements. The iron oxide in slag made in a blast furnace would differ from alumina cements made by simple fusion of raw materials because most of the iron in the bauxite would be reduced to the metallic state in the blast furnace and recovered under proper conditions as low-sulphur metal.

[1] Lindeman, Thv., and Hassel, Sverre, An investigation of high-alumina cements; Chem. Abs., vol. 19, July 10, 1925, p. 2117.
[2] Alcement La Farge.
[3] Bied, J., (The cements of high alumina tenor): Jour. du Four Electrique, 32d yr., 1923, p. 13.
[4] Analyses by author of an American Cement.
[5] Sample had been stored several years.
[6] Christian, R., Fused cement or "alcement;" Chem. Abs., vol. 18, March 20, 1924, p. 890.
[8] Chemical Abstracts, Vol. 19, Aug. 10, 1925, p. 2396.

The work by Rankin and Wright[9] on the ternary system lime-alumina-silica indicates that alumina cements have relatively low fusion temperatures. Figures 1, A and B, taken from their report, show that the compounds containing approximately equal amounts of lime and alumina, and perhaps 5 to 10 per cent of silica, have comparative low melting points. The ternary eutectic for $B_2CaO.SiO_2$, $CaO.Al_2O_3$, and $5CaO.3Al_2O_3$, which has a composition of 49.5 per cent of CaO, 43.7 per cent of Al_2O_3, and 6.8 per cent of SiO_2, melts at 1,335 degrees C. ± 5 degrees. Even small amounts of such a eutectic would have a very appreciable effect upon the temperature-viscosity relations of the slag, a matter of great importance in blast-furnace operation.

E. C. Eckel[10] has obtained several patents on a process for making iron and cement in the blast furnace, but the experimental-furnace test is, so far as the writer is aware, the first systematic experiment to determine whether the iron in the charge can be reduced to the same extent as in normal blast-furnace practice. Alumina cement has been made in water-jacketed furnaces, about the dimensions of a cupola, but the process is primarily a melting operation and not a reducing and melting operation as is the case with the blast furnace. Slags containing about 35 per cent of Al_2O_3 have been made in industrial blast furnaces, but the general composition of such slag does not closely approach that of high-alumina cements.

Raw Materials Used in Test

The analyses (in per cent) of some 60 tons of bauxite used in the test follow:

	Al_2O_3	SiO_2	Fe	CaO	MnO	TiO_2	Ig. loss
Car 1	..57.62	2.75	16.77	0.78	0.48	2.64	13.72
Car 2	..57.06	2.78	16.32	....	....	3.08	13.41

Limestone containing about 53 per cent of CaO, 1 per cent of SiO_2, and 0.5 per cent of Al_2O_3 was used to adjust the CaO content of the slag. By-product coke containing about 7.5 per cent of ash was used as fuel. High-grade iron ore (63.5 per cent of Fe) and cast-iron turnings were used to vary the amount of iron made. The exit gas from the furnace averaged 30.32 per cent of CO and 6.83 per cent of CO_2 by volume. Its heating value therefore would be about 15 per cent greater than that of blast-furnace gas.

In addition to the value of the cement and iron produced, a substantial credit for the gas could be obtained in industrial centers or particularly in steel plants.

Economic Considerations

In considering the cost of operating a blast furnace to produce alumina cement the geographical

[9] Rankin, G. A., and Wright, F. E., The ternary system $CaO-Al_2O_3-SiO_2$: Am. Jour. Sci., ser. 4, vol. 39, 1915, pp. 40-41.
[10] U. S. Patent 1,536,381, Process of making iron and cement.
U. S. Patent 1,536,382, Process of making iron and cement.
U. S. Patent 1,535,405, Process of making iron and cement.

location of the furnace is important. Due to the advantages of securing cheap imported bauxite, it has been assumed in the following cost estimates that the furnace site is along the North Atlantic coast. Prices have been assumed for all raw materials at such a location. These estimates indicate the relative amounts of raw materials, particularly fuel, which would be required. More reliable information as to the actual cost of materials can be inserted in an estimate once the proportions of raw materials and products are known with a fair degree of accuracy.

The proportions of raw materials and products which will be given are based upon data obtained in operating a 6-ton blast furnace and upon industrial furnace practice. There might be a choice between an all-scrap charge, all iron ore and no scrap, and a combination of iron ore and scrap. Therefore three cost estimates have been made.

All-Scrap Burden

Material	Pounds Per Ton of Iron	Tons Per Ton of Iron	Cost Per Ton	Material Cost Per Ton of Iron
Bauxite	2,100	0.948	$ 6.00	$ 5.70
Stone	1,850	0.826	1.50	1.25
Borings	2,100	0.948	11.00	10.40
Coke	1,900	0.95	6.00	5.70
Cost above: Labor				$ 1.00
Maintenance and repairs				.50
Steam				.35
Relinings and renewals				.30
Other costs				.75
				$25.95
Products: Alumina cement (not pulverized) 1 ton				$30
Pig iron, 1 ton				20
				$50

All-Ore Burden

Material	Pounds Per Ton of Iron	Tons Per Ton of Iron	Cost Per Ton	Material Cost Per Ton of Iron
Bauxite	3,260	1.455	$ 6.00	$ 8.70
Limestone	2,800	1.25	1.50	1.90
Ore	2,800	1.25	6.00	7.50
Coke	3,350	1.675	6.00	10.00
Cost above				$ 2.90
				$31.00
Products: Alumina cement (not pulverized) 1.6 tons at $30				$48
Pig iron, 1 ton				20
				$68

Ore-Scrap Burden

Material	Pounds Per Ton of Iron	Tons Per Ton of Iron	Cost Per Ton	Material Cost Per Ton of Iron
Bauxite	2,175	0.97	$ 6.00	$ 5.80
Limestone	1,865	0.83	1.50	1.25
Borings	1,245	0.56	11.00	6.15
Ore	1,245	0.56	6.00	3.35
Coke	2,240	1.12	6.00	6.70
Cost above				$ 2.90
				$26.15
Products: Alumina cement (not pulverized) 1.1 tons at $30				$33
Pig iron, 1 ton				20
				$53

The amount of coke required and its ash content place a limit upon the quantity of silica which can be allowed in other materials. In general the grade of raw materials would be governed by the amount of silica sought in the cement. Slag made from an all-scrap burden would be lowest in silica, that from an ore-scrap charge would rank next, and that from an all-ore burden would be highest in silica. Even though iron ore exceptionally low in

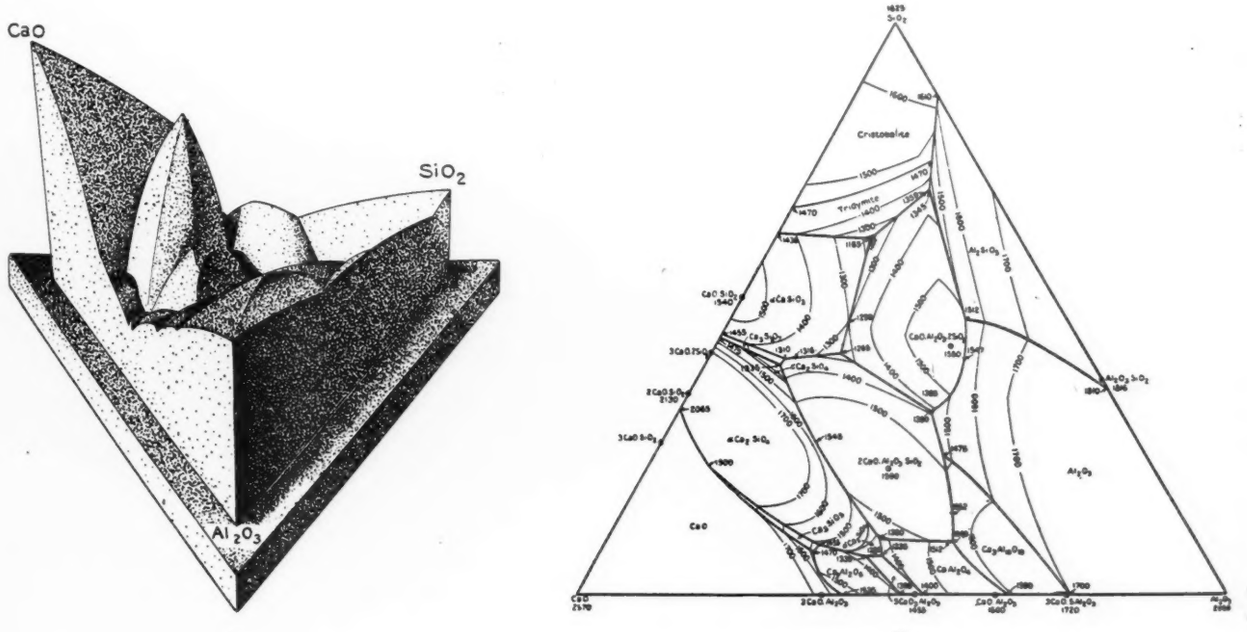


Figure 1. A, Solid model of the ternary system $CaO-Al_2O_3-SiO_2$; B, projection concentration-temperature diagram of ternary system $CaO-Al_2O_3-SiO_2$ with isotherms and melting temperatures of compounds and invariant points.

silica is used, it introduces relatively large amounts of silica and because of greater fuel requirements additional silica is introduced in the coke ash. In the material balance underlying the three cost estimates given above the percentage of silica in the various raw materials used in arriving at the three cost estimates follows: Bauxite, 2.75 per cent; limestone, 1 per cent; coke, 7.5 per cent; ash, of which about 40 per cent is silica; and iron ore, 4.5 per cent. By the use of such raw materials the cement produced would contain about 8 per cent of silica. Selection of raw materials would depend upon the composition desired in the cement.

A preliminary cost study indicates that 1 ton of metal and 1 to 1½ tons of slag can be produced in the blast furnace for about $25 to $30, allowing no credit for surplus gas. If 1 ton of alumina cement is worth $30 and 1 ton of pig iron $20 the combined value of these two products would be $50, which leaves an attractive margin for grinding the slag, marketing costs, and profit.

What About Liming Soils?

Liming soils may bring about beneficial results in several ways. It stimulates the proper decomposition of organic matter, neutralizes acids, improves the physical condition of heavy soils, supplies lime to growing plants, or makes available other elements in the soil. In any given case where there is need of lime some combination of these results is probable, and in some cases all of the benefits might follow.

In Farmers' Bulletin 921-F, "The Principles of the Liming of Soils," first published by the United States Department of Agriculture in 1918, and just revised and brought up to date by Edmund C. Shorey of the Bureau of Chemistry and Soils, the practical principles of liming are explained, the distinctions between the carbonate, oxide, and hydrate values are made clear, and farmers are warned as to unwise applications of the oxide with seeds or with manure.

New material not in earlier editions of the bulletin includes a brief explanation of the Truog test for soil acidity, and suggestions for community purchase and storage of lime.

Mr. Shorey points out that on the basis of the content of carbonate of lime in the soils, the United States may be divided roughly into two geographic divisions. "If a line," he says, "beginning at the center of the northern boundary of Minnesota, be drawn south through that Sate, curving west and cutting off the northwest corner of Iowa, thence to central Nebraska, south through Kansas, Oklahoma and Texas to near the Mexican border on the Gulf, it may be said that, generally, the soils east of that line, except in river bottoms and a few inextensive upland areas, contain but small quantities (less than half of 1 per cent) of carbonate of lime. Such soils do not effervesce on the addition of dilute acid. West of this line the soils frequently, and the subsoils always, contain appreciable quantities of carbonate of lime, except at high elevations and on the Pacific coast."

Elimination of Grade Crossings Urged

The elimination of grade crossing hazards was urged this week in a brief filed with the Interstate Commerce Commission by the American Motorists' Association in connection with the Commission's hearings on the adequacy of automatic train control. The motoring association urged that there is greater need, at the present time, for safety at grade crossings than there is for automatic block signals or train control devices. Many representatives of the leading railroads have likewise urged upon the Commission the necessity for the elimination of the grade crossing hazard.

The grade crossing problem is far more pressing at this time than block signals for automatic train control, both the association and a majority of the railroads have informed the Commission. Figures presented to the Commission by the motoring association showed that during January, the latest figures available, no railroad passenger was killed in a railroad accident. During the same month, 471 highway grade crossing accidents were reported, with a total of 185 deaths and 529 injuries, of which approximately 80 per cent were automobile-train accidents, the Association's figures show. In January of last year, the railroads reported 499 accidents, resulting in 206 deaths and 604 injuries.

"The enormous increase in motor traffic and the increase of accidents at road crossings have resulted in a major problem to the motorists and the railroads," J. Borton Weeks, President of the Association declares. "The elimination of grade crossings is far more urgent than automatic control of trains. Figures of the Commission show that from 10 to 20 times more fatalities occur at grade crossings than occur as the result of lack of automatic control."

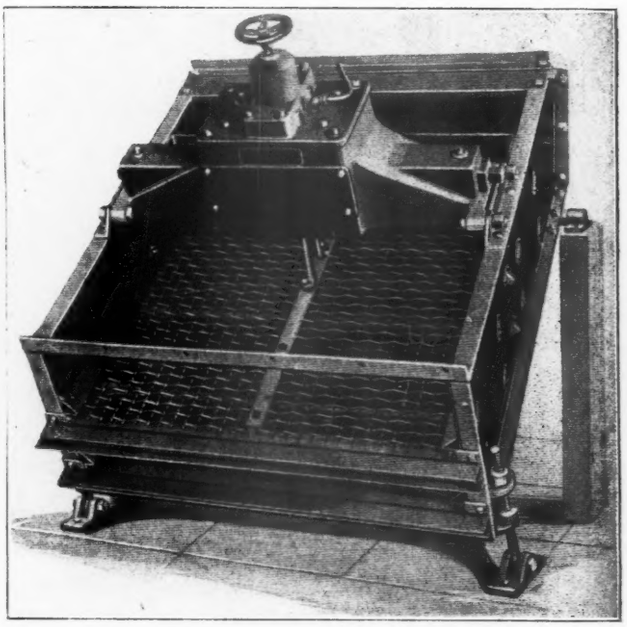
The Association cited figures from reports of numerous railroads, showing that in recent years the bulk of all accidents have been at grade crossings. As a fair example, figures of a mid-western line, operating 900 miles of track, are cited, showing that it had but six fatalities in connection with train operations during the past three years, while during the same period, 77 persons were killed at grade crossings on the same line.

VIBRATING SCREENS IN THE PIT AND QUARRY INDUSTRIES

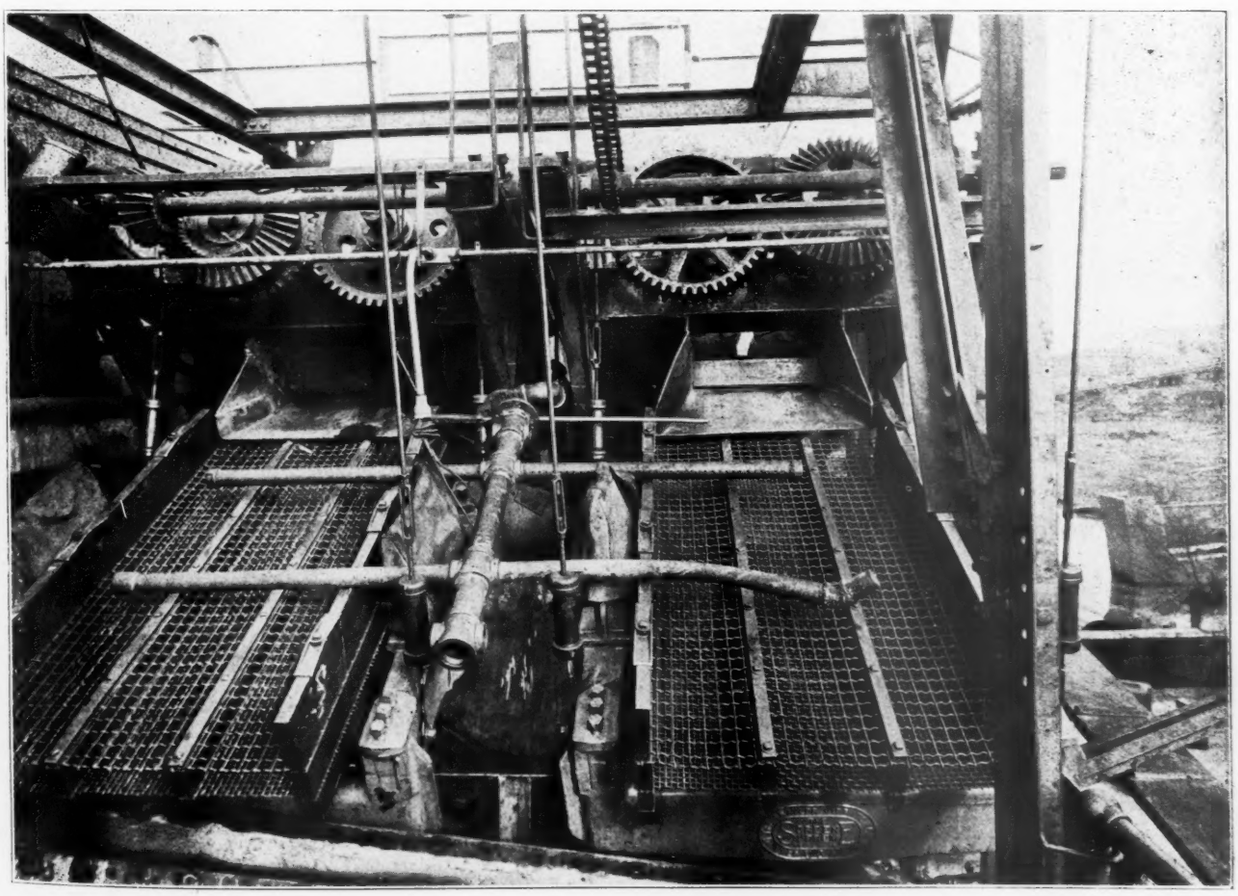
By H. W. Munday

Part One

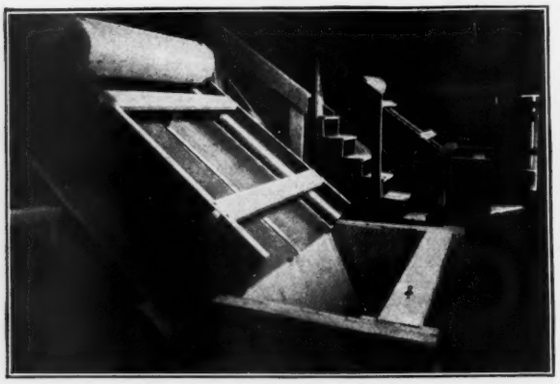
INTEREST in vibrating screens in the Pit and Quarry Industries has been noticeably marked during the past year or two. These screens have for the past several years been an important factor in the sand and gravel plant, and now we find them an important factor in the crushed stone plant. In a large number of sand and gravel plants all screening and sizing is handled by vibrating screens. In a large number of crushed stone plants vibrating screens are used on all the minus 1½ inch material. There are quite a number of crushed stone plants that handle everything from 2½ or 2 inches down with vibrating screens. A notable example of this is Dolomite Incorporated at their Maple Grove, Ohio, crushed stone plant where all the minus 2 inch stone is handled by vibrating screens. Another interesting feature in the use of vibrating screens is their use on dredges. In some instances the vibrating screens are used to make a separation of the sand from the gravel before loading the scows. In other installations the vibrating screens are a part of a complete floating



A Hummer Heavy Duty Unit



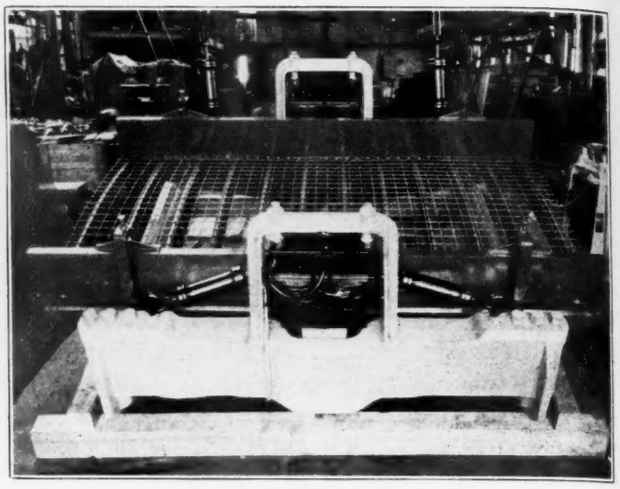
Traylor Vibrator Screen on a Dredge Boat



Universal Screen Handling Limestone Separation at Eight Mesh in a Pennsylvania Plant

plant that prepares sized material on the dredge or boat.

In this article we shall first describe a number of different vibrating screens that are in use in the Pit and Quarry Industries. We shall then discuss some of the reasons why certain actual installations were made. Rather than classify the various vibrating screens on the market and discuss them by groups we shall discuss the different units without favor or classification and then in the last part of the article present a tabular classification.



The Traylor Screen

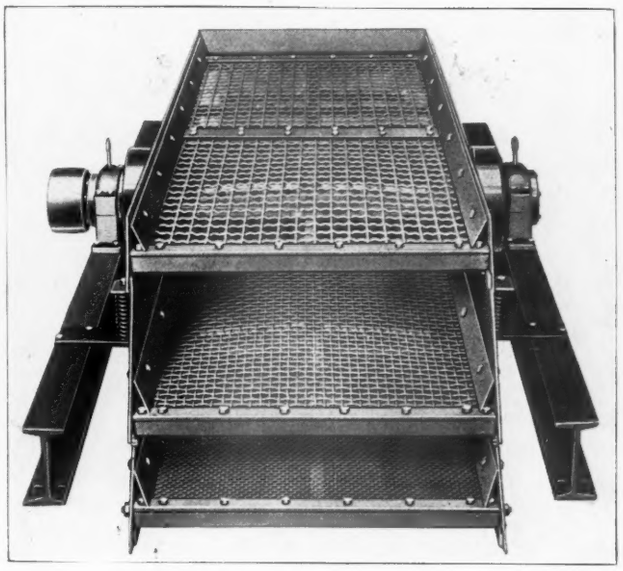
The W. S. Tyler Company introduced the Hummer vibrating screen about ten years ago. In this screen 1800 vibrations per minute are applied to a taut screening surface with a reciprocating vibratory motion by means of an electro magnet. This electro magnet is mounted above an armature which is rigidly fastened to the taut screening surface by means of an armature post and bracket. The magnet is then operated by 15 cycle alternating current. As the current alternates, the arma-

Niagara Screen in a New York Sand and Gravel Plant

ture with the attached screen is jerked sharply upward. At the zero points in the current, the armature and screen are released. The upward stroke of the armature is stopped by striking blocks with a sharp impact. The screen does not have any wavelike motion, as each impulse is stopped with a decided jar.

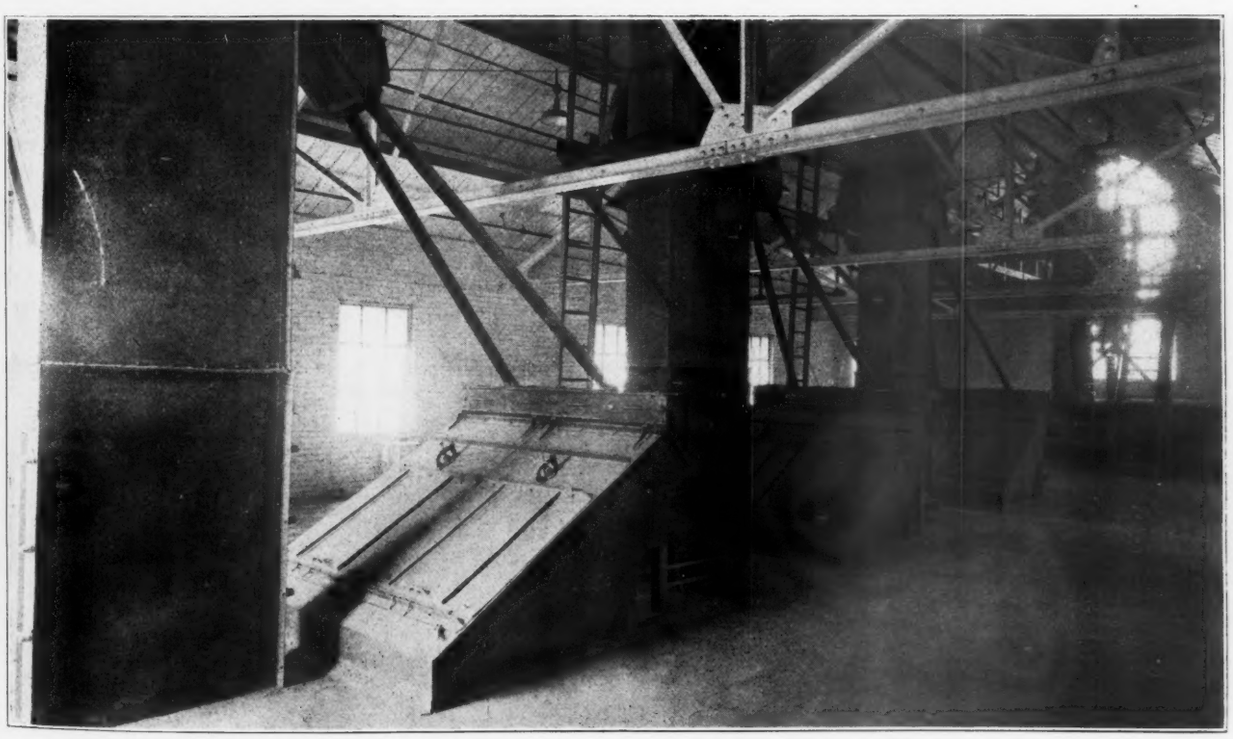
In the Hum-mer, the vibration applied to the screening surface only, and the direction of the vibration is at right angles to the screening surface. The screen is made in one, two or three deck units. The power consumption is low, from ½ to 1 h.p. per screen. This screen has a wide range of adjustability. The same vibrator may be used for coarse or fine screens, for heavy or light loads and for wet or dry material.

The Niagara vibrating screen has a rotary vibratory motion against the flow of material imparted to the screen cloth by means of an eccentric arrangement mounted on a belt driven shaft running in dust tight roller bearings at from 500 to 3,000 r.p.m. The action is such that the screen vibrates both horizontally and vertically. The eccentrics are positive in their action and have the same throw at all speeds. The eccentric shaft is made of hercules steel and runs on large molybdenum steel ball bearings housed in dust proof self-aligning housings with large oil reservoirs equipped with labyrinth seals. The unit is lubricated by the Alemite system. The Niagara is made in several sizes with one, two or three decks. The screens are mounted in panels, two panels to each surface, which makes for speed in changing screen sizes. These panels may be removed from either the front or rear end and may be equipped with different mesh screens for various sizes.

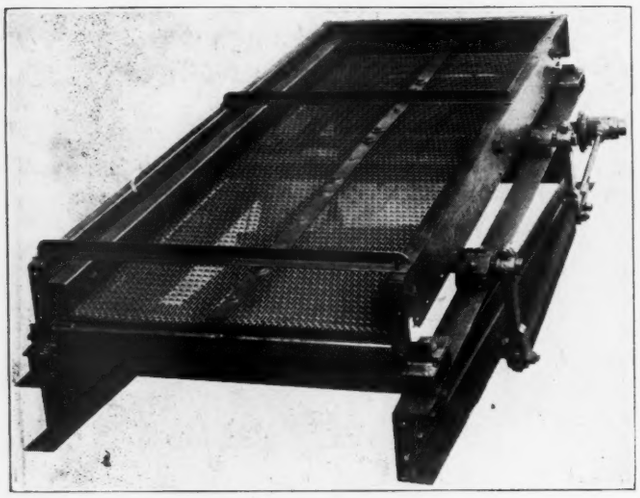


A 3 Deck Niagara

The Universal vibrating screen has an elliptical vibratory action with the greater axis of this movement in a direction perpendicular to the plane of the screening surface. There is a certain amount of end motion, but the greater motion is in the direction perpendicular to the screening surface. This motion is imparted to the entire screen cloth frame by means of unbalanced revolving weights mounted on a belt driven shaft running in dust proof ball bearings at 1800 r.p.m. The screen frame is supported on each end by a full elliptic steel spring giving a maximum motion perpendicular to the cloth and a minimum motion length-



A Battery of Sturtevant Motor Vibro Screens



The Cottrell Slugger Screen

wise. The two point suspension with shackle alignment tends to distribute the material evenly over the screen surface. The center channel running longitudinally through the Universal screen frame, with its center strip and light jacks above the cloth permits speedy removal of the screen cloth. It also serves as a safety factor in keeping the cloth from whipping and tends to prevent sagging caused by the weight of the material. The distance between supporting points of the screen cloth in the Universal is short.

The Universal is made in single deck units only, and the standard size is 3 by 8 feet. About ¾ h.p. is required per screen for the usual conditions of load and moisture content.

The Traylor vibrating screen is an electrical vibrating screen with the vibration perpendicular to the cloth and of equal magnitude throughout the cloth length. A screen sash vibrates up and down and imparts an even and uniform motion to the screen cloth which is attached rigidly to it. The vibrating motion is produced directly by reciprocating motors and transmitted to the screen sash without change through rigid members. These motors are built into the main frame, one on each side of the sash. These motors consist of two main parts, a stator attached to the screen frame and an armature attached to the screen sash. These reciprocating motors are operated by a pulsating electric current which is obtained by adding a small amount of direct current from a d.c. generator to an alternating current of 110, 220 or 440 volts. With the introduction of the pulsating current, the armature is alternately pulled and released, and the screen sash is thus set in motion. The flexible

Leahy Screens in Union Rock Company Plant

members of the motors are designed to have a period of vibration under their load about equal to the pulsations in the stator. The screen is supported on hangar rods containing a vibration absorbing cushion. Practically no vibration is transmitted to the supports to which the screen is fastened. The speed of vibration is 3600 vibrations per minute. The Traylor screen is made in several different sizes.

The Roberts and Schaefer vibrating screen (also known as the Arms screen) has a combined rotary and reciprocating motion at 500 r.p.m. The vibration is obtained by ball bearing eccentrics. The discharge end of the screen is supported upon either rocker arms or links underneath the deck or from hanger boards from an overhead structure. In this screen the greatest vibration is at the head end. As the material moves toward the discharge end, the motion of the screen is proportionately cut down until just before the material leaves the screen this motion is approximately horizontal with just enough lift in the direction of discharge to keep the material moving.

The drive head is equipped throughout with ball bearings of ample size which are protected by a dust seal of the labyrinth type. Lubrication is by the high pressure method. Alemite fittings are standard equipment. A 3 h.p. motor is usually sufficient for a single deck unit and a 5 h.p. for a double deck unit.

The Leahy vibrating screen manufactured by the Deister Concentrator Company has a reciprocating vibrating motion imparted to the screen cloth only by means of an 8 tooth tool steel, heat treated cam running at 200 r.p.m. in a bath of oil and producing 1600 vibrations per minute. Vibration is transmitted from the vibrator cam through a connecting rod to a rigid member attached to and extending transversely across the underside of the wire screen cloth. The sides of the screen cloth are free to vibrate. Vibration is perpendicular to the screen cloth and is in a line across the screen cloth. The maximum vibration is greatest at the center of the cloth. One spring adjustment controls the intensity of vibration. The rate of vibration can be changed with the driving speed. The screen cloth is held in longitudinal tension by two bolts and can be changed quickly. The Leahy is made in several sizes either one or two decks. The screen requires ½ h.p. and 1 h.p. is recommended.

The Sturtevant Mill Company's Moto Vibro screen has a reciprocating vibratory motion in a direction perpendicular to the screen cloth. The vibratory motion is imparted to the entire screen cloth frame by means of an eccentric operated push rod opposed by a coil spring. The eccentric mechanism is encased in oil and belt driven at 1800 r.p.m. These screens are built in standard and heavy duty units and in one, two or three deck. The manufacturer recommends a 2 h.p. motor which should be sufficient for the usual conditions.

The Pittsburgh vibrating screen has a reciprocating motion perpendicular to the screen cloth. Vibration is imparted to the entire screen cloth frame by means of an eccentric shaft mounted in self aligning ball bearing pillow blocks. The eccentric connecting rods are carried on self aligning ball bearings and attached to the screen frame supports. The cloth frame is supported on spiral steel springs. This screen is made in single or double deck units of various sizes.

In the next issue we shall continue this discussion of the different types of screens and also present some installation and operating data from the field. The vibrating screens of Robins Conveying Belt Company, Link Belt Company, Simplicity Engineering Company, Orville Simpson Company, Norwood Engineering Company, Cottrell Engineering Company, C. W. Hunt Company, etc., will be described.

Crazing of Cement Mortars

P. H. Bates and C. H. Jumper of the United States Bureau of Standards presented a paper entitled "Notes on the Progress of Some Studies of Crazing of Portland Cement Mortars" at the 24th annual convention of the American Concrete Institute. This supplements the paper "Crazing on Cement Products" which Mr. Bates read before the Institute in 1925, and gives the results of a series of test panels of mortars at the Bureau of Standards.

Considering the data so far acquired and neglecting all except the mortar bases it was noted that the sand-area cement ratio varied from 2.9 to 29.1 and the fineness modulus from 1.7 to 4.9. As long as these panels were in the laboratory, no crazing resulted on those where the lower percentages of water had been used, but after having placed there on the roof there was some slight evidence favoring the mixes with the high sand-area cement ratio. Increasing the amount of mixing water about 10 per cent had no effect, but changing the sand area cement ratios to about 12 to 13.7 caused some improvement. This data shows then that the more of the fine sand present the less of a tendency there is to craze, while the fineness modulus itself is an erratic guide in decreasing this tendency.

After a year and a half of work, nothing very tangible for solving the problem of crazing has been obtained except an estimate of the magnitude of the effect of some of the variables, particularly humidity and temperature, in causing this annoyance. This is important and will assist materially in leading the present and future more directly toward solving the crazing problem.

Egyptian Market for Cement

By Charles E. Dickerson, Jr.

Acting Commercial Attaché, Cairo

Building has been an outstanding activity in Egypt for the past 10 years and conditions today indicate continued expansion. As a consequence, large quantities of cement have been and will be imported from abroad. There is one large cement factory in Egypt which produces a fair-quality product but this supplies only a part of the country's needs and a small portion for export to nearby markets. The lack of a local fuel supply and the cheapness of imported cement constitute the greatest handicap to the expansion of the domestic production.

The prosperity in the building trade in recent years is attributable in large measure to the gradual Europeanization of steadily increasing sections of the larger centers. Both Cairo and Alexandria at present are divided into two districts, old and new. In the new section the European elements reside and do business and the buildings are of modern construction and have most of the improvements of western civilization. The old town is made up of the native quarters where narrow crooked streets separate old and cheaply built houses of the Turkish harem type. The former section is steadily expanding in both cities and the latter is gradually receding and disappearing.

Other factors which have contributed to the activity in the local building trade are the higher rates paid for flats and houses in the new sections, the protracted business depression which has induced wealthy merchants to turn their attention to the regular income from real property, and the intervention of the authorities in the case of old building conditions, which presented a menace to life. The collapse of old houses has been a frequent occurrence in the past and in Lower Egypt, where the rainfall is heavy during two or three months of the year, the danger still exists.

Egypt lacks a domestic supply of stone and lumber, but there is plenty of sand and gravel, and concrete is therefore a natural building medium. Rebuilding operations in the old quarters have created a large demand for cement, which is reflected in the official import statistics of the Egyptian government. In 1921 there were imported 39,160 metric tons of cement, as compared with 179,578 in 1926 and 185,010 in the first 10 months of 1927. The United States thus far has not participated to any appreciable extent in this trade, although a negligible quantity of American white cement is being imported through England. The principal foreign sources of Egyptian cement imports are Jugoslavia, Belgium, Germany, the United Kingdom, and France, in the order named.

Palestine cement recently made its appearance on this market. The quality is good and it sells at somewhat higher prices than the other imported varieties. It is probable that this product will remain at a relatively high level of prices for some time to come, owing to the necessity for importing fuel for manufacture.

The damp Egyptian climate made underground cellars impracticable under the old building system. The present use of cement and other waterproofing material has increased floor space. The larger buildings now going up require deeper and more reliable foundations, since the soil is only just above sea level, and in many places in Lower Egypt is even below. The contemplated improvement of the roads and other works projected by the government are also factors in increasing the demand for cement.

Cement is imported into Egypt today by merchants and a few commission houses; they buy for their own account and resell to contractors who receive a credit varying from two to three months. Stocks are never large as the damp weather causes rapid deterioration. The retail price for imported cement in Cairo varies from $15 to $20 per ton, delivered on the spot, according to grade. The local product is of the lower quality and sells at about $15 at present.

Exports of the cement locally produced totaled 165 tons in 1925, 116 in 1926, and 21 during the first 10 months of 1927. In 1926 and 1927 the exports were not classified by destinations; in 1925 the principal shipments were 76 tons to Cyprus, 41 to Rhodes, and 39 to Palestine. Reexports of imported cement amount to 86 tons in 1925 (almost entirely to Cyprus), 64 in 1926, and 76 in the first 10 months of 1927.

Earnings of Leading Industries

A mixed trend in the past year's earnings of various industrial groups as compared with the previous year is revealed in a study by the Federal Reserve Bank of New York. Net profits of the industries considered are shown to have ranged from a high of 56 per cent above, to a low of 48 per cent below those for 1926.

The high gain for the year was registered by the leather and shoe industry. Other increases reported are: rubber 50 per cent, retail stores 15 per cent, drug and chemicals 10 per cent, and motors 5 per cent.

Oils with a reduction of 48 per cent and steel 25 per cent head the list of industries showing a decline in profits. Decreases were also suffered by building supplies 15 per cent, metal and mining 15 per cent, and food and food products 4 per cent.

Average profits of 381 industrial and mercantile concerns were reported as 8 per cent below the 1926 level. Declines in certain large industries, notably oil and steel, are considered largely responsible.

PURCHASING POLICY AS A MEANS OF SCIENTIFIC PURCHASING

By J. J. Berliner

FOR some reason or other, the purchasing departments of a great many concerns are frequently found to be very loosely connected with the rest of the organization. Undoubtedly this is most probably due to the fact that when a business is started, the buying is done by either the proprietor himself or the manager, but as soon as the business grows a little larger, the purchasing end becomes a function delegated to someone directly attached to the manager's or proprietor's office without being adequately correlated with the organization as a whole.

The need of proper coordination of the purchasing department with the remainder of the business is fundamental. The purchasing policy of the concern should reflect as far as is possible, the needs and requirements of the business as a whole, and that can be done only through organized contact with the different factors of which the business consists.

To obtain the proper coordination of the purchasing department with the remainder of the business, each concern should have some kind of a purchasing policy, under which certain rules of procedure should be established to control the purchasing end of the business. Of course, there are no general rules that can be laid down as applicable to business in general. Each concern varies from the other so that the management must formulate its own rules. In every concern, the management should have certain purposes that it wishes to accomplish, and to carry out its objective, it should establish such rules or policies as will in its opinion obtain these objectives. It goes without saying that the determination of policies is a matter of judgment; that the policies will be effective, harmful or indifferent as the judgment of the management is sound or otherwise. In determining the purchasing policy of a concern, a study of all the considerations that might affect the purchasing should be thoroughly studied so that the management be in a proper position to formulate a proper policy.

The various considerations and factors to be considered in determining a purchasing policy are both numerous and complex even in a business of moderate size. Some of the most important factors to consider are as follows:

1. Value of continuous and adequate source of supply.
2. Value of friendly attitude on part of supply houses.
3. Need of credit leniency or extensions.
4. Trend of business conditions.
5. Desirability or necessity of long-time or short-time contracts and feasibility of sliding scale contracts.
6. Buying futures and hedging.
7. Speculation.
8. Control by budget and schedule.
9. Fluctuation of the market.
10. Buying against specifications.
11. Desirability of requiring competitive bids.
12. Need of buying from brokers.
13. Buying through subsidiaries.
14. Relative importance of price or service.
15. Credit of supply houses.
16. Methods of supply houses.
17. Deferments and cancellations.
18. Influence of sales policy on purchasing policy.

1. The importance of maintaining a continuous and adequate source of supply depends, to a large extent on business conditions. When the supply of raw materials is very plentiful, as in periods of depression, this consideration is not so significant as in periods of great activity. Ordinarily, however, a large business must carefully consider the problem of continuity and adequacy of its supply of materials. The majority of purchases must accordingly be confined to a limited number of sources so that the favored supply houses will feel under obligation to provide for special demands. On the other hand, the purchases must be distributed over a sufficient number of sources, so that if one source should be suddenly cut off by labor difficulties, fire, financial adversities, and the like, the major portion of the supply will not be endangered, and the substitution of another source will not be made too difficult.

2. The value of a friendly attitude on the part of supply houses should not be overlooked. Very frequently opportunities arise for driving hard bargains, of taking advantage of technicalities, of forcing supply houses to carry out contracts that have become very disadvantageous or unfair to them, and to buy cheaper by shopping around freely, all of which are legitimate. But the best and soundest policy in this respect is to deal with supply houses in such a manner as to create a friendly attitude—a willingness on their part to go out of the way to grant a favor; for at times a business needs special favors, such as rush shipments, credit extensions, etc.

3. The need of credit leniency or extensions is often not anticipated at the time of organization

of the business. Very frequently it happens that a business, though prosperous, is limited financially. By concentrating purchases with a few supply houses, the amount purchased from each becomes considerable and the creditors are more likely to work closely with the purchaser and extend more credit to him in times of stringency. Buying from a few houses in order to secure more credit and to insure temporary protection in times of trouble, has its disadvantages in the fact that the purchaser is restricted and partially controlled by the supply houses. That is the premium that must be paid for credit services.

4. In the determination of a purchasing policy the trend of general business is a vital factor. A rising price level, particularly if it is accompanied by increasing business activity, makes buying in advance for longer periods than ordinary advantageous in that it gives greater assurance of adequate supply and permits of lower prices by quantity buying without running an undue risk of loss in inventories. The trend of business and the price level must be carefully watched, however, especially if the price trend is ascending rapidly. Under such conditions the temptation to buy further and further in advance is exceedingly strong, and a sudden change in the trend may easily force on the business a tremendous loss through price reductions on inventories and goods on contract. This temptation is very subtle and for that reason, hard to resist. Moreover, the difficulty, or threatened difficulty, of securing sufficient materials sometimes looms so big that it tends to overshadow the fact that one is buying far in advance and thus running the risk of making inventories top heavy.

A falling price level has the opposite effect. The possibility of buying goods in the near future at reduced prices and the ease with which goods can be procured tend toward "hand to mouth" buying. The difficulty which even very experienced and well trained business men encounter in predicting even approximately the trend of price levels and business activity, has caused many to follow a sort of straddling policy in reference to economic trends. They do not buy very far in advance when the level appears to be on a long upward swing or very close when the level appears to be on a downward swing. They are satisfied with an average buy.

5. The general trend of price levels and business activity is a large factor in determining whether goods should be purchased on long or short-time contracts but not the only one. Frequently the initial cost that a plant incurs in order to manufacture supplies is such a large factor that if it is assured of continued operation for a definite amount of business, it can make a marked concession in price. If the purchasing firm wishes to take advantage of such concessions granted on long time contracts, it should, when the trend of prices is downward, arrange to have prices readjusted each month or at other definite intervals on the basis of a predetermined scale.

6. Buying futures and hedging to eliminate speculation in buying may be desirable. Sales in a business may be made for future delivery but at fixed prices. It may then be advisable, in fixing a price, to know definitely what the raw material will cost. A purchase for future delivery is accordingly made at the time the sales contract is accepted, so that the business is protected in case of an increase in cost. If the price falls instead of increasing the business does not gain thereby. Hedging consequently eliminates the speculative feature.

7. The question of the extent, if any, that purchasing should involve speculation is present in a falling as well as in a rising market. Whether speculating is to be a phase of purchasing policy depends on opinion only. In the main, purchasing departments are not equipped to speculate successfully, and frequently the management is of the opinion that in other respects speculation in the purchasing department is harmful. The purchasing policy should define the management's position in regard to speculation.

8. Budgetary purchase control is coming more and more into favor in many enterprises. The sales estimate is used as a basis for establishing the production schedule. This schedule in turn determines the amount of stock required by periods, and the stock requirements govern purchases. Based on the production schedule, a purchasing budget is set up for materials, which gives the limits within which the purchasing department must operate. Such a control restricts the purchasing to the buying of balanced stocks and in that manner affects the purchasing policy.

9. Markets frequently fluctuate. This may be utilized for purposes of speculation or met in part by hedging. It may be met also by continuous equalized buying as prices ascend and fall so as to realize an average price. This procedure has many advantages as it simplifies the handling of fluctuations and eliminates the temptation to speculate.

10. If specifications are established for the materials to be purchased in order to secure standard materials or to meet technical requirements, the purchasing policy is of course affected. Specifications frequently limit the range of sources of supply. Moreover, it makes purchasing a narrower function than when purchasing also involves determination of the quality of goods to be brought.

11. In order to provide against favoritism and to encourage competitive bidding, it is often desirable to adopt the rule that specifications must be submitted to a number of supply houses, and that the lowest bidder receive the contract, provided he is otherwise satisfactory. Such rules, of course,

have their limitations. They tend to slow up buying and place restraints on the buyer. Moreover, by including in the specifications certain requirements the competitive bidding may be limited.

12. In determining a purchasing policy, the relative advantages and disadvantages of buying from brokers or direct from the supply house must be carefully weighed. Price advantages in buying direct may be so substantial as to warrant so doing even if it means long-time contracts. To confine all buying to direct sources, however, places the business out of touch with the market. To maintain this touch it may be advisable to do some buying from brokers, even if there is a price disadvantage in doing so. A purchasing agent should have persons in close touch with the market upon whom he can call at any time for price information. Unless some buying is done from such persons, this information in time becomes unavailable. If buying must be in small quantities there may be no price advantage in purchasing direct and buying may be done exclusively through indirect sources.

13. In order to have a satisfactory control over sources of supply, or to secure a lower cost it is sometimes advisable to acquire the sources of supply outright and operate them as subsidiary companies. Although there are very distinct advantages in operating such subsidiaries, there are also some limitations. The greatest limitation is that such sources are ordinarily industries allied to the principal one and are consequently affected in the same manner as the main business by changes in economic conditions.

In the distribution of a number of products, such as building materials, the best prices can often be secured only by regular dealers. Subsidiaries are sometimes organized to serve nominally as dealers but primarily as agencies through which materials are purchased.

14. The purchasing policy is compelled at times to take into consideration the relative importance of price or service. Assuming that certain standards of quality must be met, the purchasing policy may have to emphasize price or service. Ordinarily, of course, both of these factor are emphasized but when purchasing is balanced very closely with production such factors as promptness in shipping, uniformity in quality, condition of packing, disposal of adjustments and the like may be so important as to warrant a slight increase in price.

15. The financial standing of the supply houses with which a firm deals, affects the purchasing policy; for in case the houses have to be paid promptly, no leeway is left open to the purchaser in case of a financial stringency. Furthermore, a large buyer may find that if he acts within his legal rights and suddenly closes down on his purchases, he will financially embarrass the supply house. While this would be altogether legitimate, the management of many concerns would dislike very much to do this, and to a limited extent, would be inclined to sacrifice themselves.

16. Methods of management differ; some concerns are slovenly and dilatory in their methods, others tricky. Some have very definite policies which they maintain in fair and foul weather, others have policies which are trimmed according to the wind that blows. A purchasing policy is not complete which does not consider the methods and policies of supply houses from which goods will be purchased.

17. The question of deferments and cancellations ordinarily does not arise on a big scale except in periods of economic depression. The possibility of deferment and cancellation is, however, too vital a matter to be overlooked in determining a purchasing policy, because periods of depression may find the business without any method of securing relief from the in-rush of goods not needed by the business.

A method of providing for deferment or cancellation is to have the purchasing contracts contain a provision stipulating that the delivery of the purchased goods may be deferred a given period in return for a specific consideration, or that the contract may be cancelled in return for a fixed payment. It is ordinarily difficult to get the supply houses to agree to such a provision in the purchasing contracts. It can however be done, and if confined to the important contracts only, the burden placed on the purchasing department in this respect is not heavy.

There is considerable opposition to deferment or cancellation on the part of many business men but that is directed to deferments or cancellations which are not provided for in contracts, but are forced on the supply house in one way or another. This opposition should not apply where provision for deferment or cancellation is made in the contract.

18. Another factor which may have to receive careful handling in the determination of purchasing policy is the influence which sales policy should be allowed to exert. A business frequently sells its product to houses whose goods may be purchased by it. The sales department frequently has so many customers who want to be favored that it cannot possibly please all. It has a much stronger position then, if it can show that it has no influence in the purchasing department where considerations of standardized service govern.

A classification of the factors discussed above should be helpful in arriving at a method of determining the policy to be pursued. In the main, the purchasing policy of a business is not static. On the contrary it is continually evolving. Certain phases of the purchasing policy can remain the same throughout the life of the business; a second group, or phase, depends on the growth of the busi-

ness, its financial condition and its policies in reference to production; and a third group depends largely on external economic conditions.

The factors or phases which can remain more or less fixed are: Value of friendly attitude on the part of supply houses; buying against specifications; relative importance of price or service; control by budget and production schedule; desirability of requiring competitive bids; credit of supply houses; and methods of supply houses.

Those which are dependent on the growth of the business and its condition, are: Value of continuous and adequate source of supply; need of credit leniency or extensions; desirability or necessity of long-time or short-time contracts and feasibility of sliding scale contracts; need of buying from brokers, buying through subsidiaries; buying futures and hedging; fluctuation of the market.

The evolutionary character of the purchasing policy makes it desirable that the policy be subjected to review at definite intervals. Thus in some large concerns, the purchasing policy is reviewed once a month by the executive board. The executive board usually consists of the heads of the principal divisions of the business, the purchasing policy being constantly moulded in the interest of the various phases of the business.

In smaller concerns, the responsibility for the review of the purchasing policy lies with the manager, except so far as it has been delegated to the purchasing agent.

However, reviewing the purchasing policy at frequent intervals should not be the sole agency for establishing closer relationship. The purchasing department should be so organized, that it has a definite relation to the financial department, the production department, and the sales department. The establishment of such a relationship between the purchasing department and the other departments of the business through proper organization is of the greatest importance.

Bank Liabilities Decrease

Liabilities of commercial concerns declared bankrupt in the United States during the first quarter of 1928 average approximately 11 per cent less per concern than in the corresponding period of 1927, it is revealed by a study of data gathered by R. G. Dun & Co. The average indebtedness per failure during the first three months of 1928 is shown as $20,910 compared with $23,502 last year.

Net losses suffered by creditors, as represented by excess of liabilities over assets, total 18 per cent less this year than in 1927, the data indicate. Aggregate first quarter liabilities in 1928 were $147,519,198 with assets of $76,474,077. In 1927 liabilities aggregated $156,121,853 and assets $69,204,418.

The number of insolvent concerns increased. During the first quarter of 1928 the number of bankrupt concerns was reported as 7,055. In the corresponding period of 1927 the number was 6,643.

Manufacturing contributed 1,567 bankrupt concerns during the first quarter of 1928. Failures among the trading concerns number 5,093. In miscellaneous lines the failures numbered 395 concerns. In addition 109 banks were reported insolvent with liabilities of $36,802,098.

Freight Car Loadings

Revenue freight loadings for the week ending April 21 totalled 944,694 cars, the American Railway Association announced, an increase of 32,317 compared with the preceding week. Increases were reported in the loading of all commodities.

The total for the week was a decrease, however, of 5,851 cars below the same week in 1927 as well as a decrease of 28,464 cars compared with the corresponding week two years ago.

	1927	1926	1925
Sept. 3	1,117,069	1,143,448	1,102,785
Sept. 10	989,472	1,024,998	975,499
Sept. 17	1,127,613	1,182,641	1,112,009
Sept. 24	1,125,868	1,175,407	1,121,025
Oct. 1	1,126,390	1,180,049	1,113,283
Oct. 8	1,100,552	1,074,928	1,106,036
Oct. 15	1,119,872	1,202,780	1,106,009
Oct. 22	1,128,486	1,200,941	1,120,677
Oct. 29	1,112,621	1,208,878	1,091,154
Nov. 5	1,038,852	1,112,621	1,062,646
Nov. 12	974,862	1,106,889	1,049,940
Nov. 19	968,103	1,071,707	1,057,923
Nov. 26	840,803	937,844	923,206
Dec. 3	918,237	1,054,048	1,023,666
Dec. 10	877,600	992,855	1,008,696
Dec. 17	868,162	944,396	969,738
Dec. 24	829,006	768,940	969,738
Dec. 31	679,600	734,281	701,061

	1928	1927	1926
Jan. 7	754,062	933,940	907,622
Jan. 14	906,734	942,731	931,735
Jan. 21	884,095	936,160	921,643
Jan. 28	902,832	943,879	925,696
Feb. 4	926,204	965,664	914,491
Feb. 11	906,009	962,602	917,625
Feb. 18	887,891	954,794	932,281
Feb. 25	869,590	918,858	912,935
Mar. 3	959,537	989,863	965,009
Mar. 10	951,553	1,000,754	967,425
Mar. 17	942,086	1,001,932	977,018
Mar. 24	950,428	1,003,536	967,945
Mar. 31	950,249	986,462	928,303
April 7	919,296	953,907	929,343
April 14	912,377	949,561	964,794
April 21	944,694	950,545	973,158

SOME CAUSES OF SUCCESS AND FAILURE OF BITUMINOUS MACADAM PAVEMENTS

By Squire E. Fitch
Superintendent of Highways, Chautauqua County, Jamestown, New York

NEW YORK has 30 per cent of all its roads improved, which means it has enough hard surfaced roads to reach around the world. It has 6,500 miles of bituminous macadams alone, which is 36 per cent of all the bituminous macadam in the United States. About half of these roads were built by the state, mostly between the years 1908 and 1914. During that period, a large percentage of improved roads were of three types; waterbound macadam, second class concrete, and bituminous macadam. The second class concrete roads were built by taking a large quantity of water and mixing it with one part of Portland cement to six parts of dirty run-of-bank gravel; sometimes mostly all sand, sometimes nearly all pebbles; always part of the cement was washed away by excess water.

The asphaltic macadams were built in various ways; some were well built, many were hand-poured. Some were rolled too much prior to the first pour; some were rolled in wet weather so that the mud squeezed up between the stones. Frequently too much seal coat was used. The quality of the asphalt varied but always the specifications permitted asphalt of too soft a grade, 150 to 200 penetration.

Some engineers will tell you that the cost of maintaining bituminous macadam is high. The average cost of maintenance of the asphaltic penetration roads in 1925 is given as $1,010 per mile. These maintenance figures cover old roads, built in the manner described , and also that 30 per cent of the New York state roads built prior to 1914 were only 12 feet to 14 feet wide and some even less. The figures, $150 per mile, for maintenance of bituminous macadam roads built in Rhode Island since 1914 are interesting. They are more nearly what we can expect of modern work and may be fairly compared with the cost of maintaining first class concrete roads in New York which have been built since 1914. In 1925 their maintenance cost was $174 per mile.

For three years, I have been building bituminous macadam roads for Chautauqua County and endeavored to apply the principles I learned with the State. The methods of construction that we use do not differ much from those in Rhode Island. The cross-section of our pavement is considerably different. Our roads are too new to have such a long successful record as Rhode Island. Our roads have considerable traffic but are not the main thoroughfares; consequently we build them but 16 feet wide and eighteen inches or more in thickness.

The average cost of our pavement is $18,000 per mile, and grading, culverts and miscellaneous items bring the cost up to $22,000 or $28,000. Occasionally a soft local sandstone, with a coefficient of wear of about 7, is available in ledges, but generally no local materials are available except a poor quality of bank or creek gravel. Crushed limestone and slag are shipped in from Buffalo, some 70 miles distant. Where the hauls for imported stone and slag are long and the local soft stone is available, it is used for both bottom and top courses, but for top course, it is screened to larger sizes than hard stone or sizes between 1¾ and 3¾ inches. The tailings and small sizes are used for a bottom course. The tailings readily crush under the roller and the small stone is used for the top. The roller is run over it not more than once or twice prior to making the first pour of asphalt. The key stone and chips which should be of hard stone, can be made to take the wear by using a slightly greater quantity than usual, with a heavier seal coat. Where the difference in cost is not too great, a good quality of stone is used throughout the top course. A good mat is always kept over the road to prevent wear coming on the soft stone.

We use 12 inches of run-of-bank gravel for a foundation and 5-ton trucks for hauling gravel as they will show up weak spots better than a 10-ton roller. Where such spots are expected, an extra course of gravel is laid over these spots and the rest of the gravel is hauled over it. If this does not sufficiently strengthen it, gravel is added until the road is firm. The regular two 6 inch courses of gravel are laid on top of it all, raising the grade line where necessary. The gravel is loaded on hired trucks by steam shovels and spread with mechanical spread-graders built around Fordson tractors. From 300 to 600 cubic yards is put on per day at an average cost of a little over one dollar per cubic yard in place, or $4,000 per mile. When the gravel foundation is firm enough to hold up loaded 5-ton trucks without movement, we lay a 4 inch loose or a 3 inch consolidated bottom course of slag, crushed between 2½ and 3¾ inch sizes and roll the slag thoroughly, adding a fine dirty gravel for filler. This bottom course also costs $4,000 per mile. When this is as firm as a waterbound macadam, we lay a 4-inch loose or a 3 inch compact course of crushed limestone, poured with 1¾ gallons of 110 penetration asphalt, keyed with ¾ to 1¾ inch limestone. For a seal coat we use

[*] Paper presented before the American Road Builders' Convention.

½ gallon of asphalt, preferably of 150 penetration. Limestone chips, and plenty of rolling and backrolling, complete the operation.

Excavation is done by steam shovels, supplemented by trains of four 1¼ yard self-loading scrapers pulled by 10-ton caterpillar tractors. The fine grading and most of the trimming is done by one-man blade graders, built around Fordson tractors on crawlers. Stone and slag is unloaded by mechanical unloaders into bins. All gravel, stone and slag is hauled by hired trucks paid for on the cubic yard mile basis which varies for hauling each material on each road and is established by a diagramatic chart so drawn that a Liberty truck can earn $3.00 per hour provided it loses no time. By hiring trucks in this way we avoid paying for lost time.

Stone, slag and gravel are spread with mechanical spreaders. Each truck carried its own chains, hitched on and adjusted so that the chains are the proper length to drop the hooks into the rings of the spreader and motor distributors pour the asphalt. Just prior to pouring, the nozzles and maniford are blown out with live steam conducted through a steam hose from the roller to a tap which is installed between the tank and maniford. To avoid having the truck wheels of the distributor make ruts in the top course by their tractive pull, the truck is pulled with a steam roller for the first pour at the desired speed.

The main points of difference between our roads and those of Rhode Island are as follows:

The standard thickness of Rhode Island roads is 8 inches plus the extra foundation under soft spots. Our roads are 18 inches thick plus the extra foundation under weak spots. The Rhode Island top course is 2½ inches thick, while ours is 3 inches thick. The Rhode Island bottom course is 4½ inches thick while ours is but 3 inches thick. Rhode Island uses 2½ gallons of asphalt of 85 to 100 penetration on a 2½ inch top course. We use 2¼ gallons per sq. yd. on a top course ½ inch thicker of 100 to 110 penetration.

Inasmuch as bottom course is cheaper than top course and 2½ inches of top seems to be satisfactory, it appears that a little money may be saved without sacrificing strength by increasing the bottom course from 3 inches to 4 inches, and reducing the top course from 3 inches to 2½ inches. Asphalt of 85 to 100 penetration will produce a firmer road than asphalt of 100 to 110 penetration, but in New York climate, it would be for the first pour with a seal coat of one-half gallon with a 150 penetration.

The three main causes of failure of bituminous macadam pavements, in order of their importance, are: Foundation weakness; bunching up or corrugating of the surface; and wear.

To verify my impression that foundation weakness is entitled to first place as a cause or failure, I have gone over the records of the asphaltic macadam penetration roads which were built and accepted by the New York State Highway Department prior to 1914. The records of all those built subsequently I have disregarded. There were 372 roads which were built from 1908 to 1913 inclusive. Of these, only 17 were built 10 inches or more in total thickness and none of these were rebuilt prior to 1923. Of these 372 roads, 76 were 8 inches and 9 inches in total thickness and only 7 of these had to be rebuilt prior to 1923. Only 14 per cent of the 8 inch and 9 inch road are rebuilt at an average age of about 13 years. The other 86 per cent are in use and will last a considerable time longer. Of the whole 372 roads, 279 were 7 inches or less in total thickness and most of them 6 inches thick. Of these, 54 were rebuilt prior to 1923, or about 20 per cent rebuilt at an average age of 7 years. Since 1923, the records that I had available did not allow of a complete analysis but from what data I had it appeared that about 5 per cent of these were being rebuilt each year.

I call attention to the fact that the percentage of failure of the 6 and 7 inch roads was nearly twice as large as that of the 8 and 9 inch roads. This points to the fact that insufficient thickness, which is analogous to foundation weakness, was the chief cause of failure. The native soil under a pavement must ultimately carry the wheel loads, so in building a pavement it is a question of distributing the load over an area of soil large enough so that the unit pressure will not exceed its bearing power. With a rigid pavement, like reinforced concrete, this is done by making the pavement act as a beam or slab; with a flexible pavement like bituminous macadam, it is done by using such a thickness of pavement that as the pressure is transmitted downward from the wheel through the various layers, it spreads out like a cone and the intensity of pressure on any layer of the pavement decreases downward. In a pavement of uniform material, it varies nearly inversely as the square of distance of that layer from the top surface.

Farm Prices Advance

Prices of farm products now are approximately nine per cent higher than a year ago, according to the newest study to be completed by the U. S. Department of Agriculture.

The Department each month receives reports from virtually every county in the United States showing the trend of prices paid farmers for grains, vegetables, dairy products, meat animals, cotton and other products of agriculture. From these hundreds of reports the Department constructs an index showing fluctuations in the general price level received by the producers. This index shows an almost continuous, month-by-month gain since March, 1927.

TWO DIFFERENT PLANTS FIVE MILES APART OPERATED BY SAME COMPANY

NEW YORK STATE boasts many excellent sand and gravel plants and among these are the plants of the Valley Sand and Gravel Corporation. This Company is the largest producer in the Rochester District with one plant at Canawaugus, New York, on the Pennsylvania Railroad, with a capacity of 60 cars in ten hours and another plant at Wadsworth, New York, with a capacity of 30 cars in ten hours.

At the Canawaugus plant, the material is excavated and pulled into the field hopper with a Sauerman power scraper, either 3 or 4 yard scrapers being used, depending on the quantity desired. The material then is pulled out of the hopper with a feeder belt. All idlers used are the Link-Belt anti-friction type, and all belts are Goodyear, style "W." A Thomas 150 h.p. hoist handles the scraper. From the feeder belt, the material is placed on a 30 inch belt conveyor on 350 foot centers. This belt is shifted about once in three years. From here, the material is placed on a conveyor and elevated about 40 feet in the length of the conveyor which is 150 foot centers. Here the material is thrown into a Link Belt scaling screen. All material passing through the perforations in this screen is placed on a 320 foot center conveyor and taken to the top of the sand and gravel plant. Here the material is washed and sized. The screens used here are Johnson and Chapman Number O O'Laughlin jacketed. The sand is washed in two Good Roads washing boxes, one located under each screen. The water for washing is supplied by two American Well Works 6 inch centrifugal split volute pumps, from a natural water supply on the property.

The material is loaded from this plant by gravity direct to cars. Sand is stored, if so desired, in a pile adjacent to the tracks where it is reclaimed with a Barber Greene loader and portable conveyors. There is a storage conveyor running from the plant that is used for storage of one size of gravel. This gravel is reclaimed with the Barber Greene equipment. For storing the balance of the gravel, a Marion Type 440 gas friction crane with a fifty foot boom and an Owen ¾ yard clam shell bucket is used.

All oversize material is scalped out at the scalping screen and is passed to a Number 13 Allis Chalmers (Superior McCully) crusher. The discharge from this crusher places the material on a 24 inch conveyor that runs directly over the 320 foot gravel belt. This 24 inch conveyor is 45 feet long, and at the end of this belt, the material passes to two Number 3 two deck Niagara screens. At this point, any size material desired may be passed either to the conveyor running to the stone

The Canawaugus Plant of Valley Sand and Gravel Corporation

Vibrating Screen in Canawaugus Plant

plant or to a 36 inch Symons disc crusher or to the gravel belt.

Ordinarily, the material from the top deck of the Niagara screen is passed to the disc crusher, from which it returns by another 24 inch conveyor to the 45 foot belt, thence to the Niagara screens. The material from the 3 lower decks is sent to the conveyor and thence to the crushed plant, where it is washed and separated into 3 sizes. The dust is taken out at the first set of Niagara screens, and falls on the gravel belt, so any material suitable is eventually made into washed sand, rather than dust. The three deck Number 3 Niagara is used in the crushed stone plant with a stream of water played on the material.

This plant is constructed of steel and wood, and the bins discharge directly into cars by gravity, the cars being placed under the bins. A Plymouth 18 ton gasoline locomotive is used for handling cars, and places them for the Marion crane.

The Wadsworth plant is entirely different, as conditions in this deposit did not call for the same type of equipment as at Canawaugus. Here the material is excavated with a ten inch Morris pump, and discharged into a concrete de-watering sump. The water overflows from this sump back into the pond, the sand and gravel being taken to the top of the plant by means of a Link Belt dredging elevator. The material is then passed to a Johnson Chapman jacketed screen, where it is washed, thence to the bins. The sand is dropped into a Good Roads washing box, thence to the sand bin. All oversize material is passed to an eight inch Telsmith gyratory crusher, from which it returns to the sump by means of an eighteen inch conveyor.

All material to be loaded, is drawn out of these bins into a tunnel, wherein runs a conveyor that deposits the material in a car or truck loading hopper. As at the other plant, all conveyor idlers are Link Belt and belts are all Goodyear.

Electric power is used in both plants, the electricity being purchased from the Niagara, Lockport and Ontario Power Company. There is about 18 inches of overburden at each plant, the stripping being done by a Keystone gasoline skimmer and the dirt is hauled away in dump trucks. The one Keystone does this work at both plants, as they are only 5 miles apart, with a good road between.

Better Than a College Course

William Grayson, Jr., Arcade Building, St. Louis, Missouri, writes of Pit and Quarry Hand Book as follows: "Just received your Hand Book. After perusing it am convinced that your company is putting out the most educational proposition to any one interested in the subjects therein menioned. I certainly appreciate the Hand Book and several of my friends have asked to read it. It is my idea that this Hand Book imparts more information, strictly up-to-date, than a man can gain in a college course. I graduated from the University of Michigan in 1901, and since then have followed all lines of chemistry and engineering, and feel confident that your Hand Book gives to students of engineering ideas to follow. I believe engineers, whether chemical, civil or mechanical, should read it, and would realize the fact that it is not an advertising proposition."

American Methods Improve

The efficiency of American methods and workers in a number of important industries is on a high level compared with pre-war standards, a study recently made by the U. S. Labor Department reveals. The department's survey discloses a marked increase in production in proportion to the labor employed.

The petroleum industry ranks among the leaders in this advance with an 83 per cent gain in output per worker since 1914. Cement manufacturing has increased its ratio of employee productiveness 61 per cent. Other gains reported include iron and steel 59 per cent, flour milling 40 per cent, paper and pulp 34 per cent, and sugar refining 28 per cent.

This progress in industrial efficiency is attributed in part to improved processes, mass production and growing use of machinery; while a large share in the advance is also claimed to be due to the increased skill and efficiency of the workers.

PROPERTIES OF MAGNESITE

By Dr. Hans Hirsch*

LITTLE has been known up to the present time regarding the properties and characteristics of magnesite, and this is also true of the effect of the various ingredients. It has been mentioned in various places that magnesite contains 82 to 90 per cent of magnesia and from 4 to 8 per cent of iron oxide. It has also been indicated that magnesite is highly resistant to high temperatures and also to the corrosive action of slag, but it is also sensitive to changes in temperature. Due to the pronounced basic character of the substance, it occupies a special position as compared with all the other refractory materials.

The composition and the properties of the magnesite must be accurately known in order to make proper use of the substance. It is known that iron oxide is important as a sintering material, and it has also been established that silica and alumina enhance the sintering action of the iron oxide or of iron compounds as well. The lime content in the magnesite is regarded as detrimental.

Numerous tests have recently been made on various samples of magnesite. Some of the results obtained in these tests and analyses are given below in tabulation number 1.

TABULATION No. 1

Designation	Ia	Ib	IId	IIIa	IIId
Analysis					
Insoluble in acid	3.0	...	...	...	...
Soluble in acid					
Silica	5.1	5.4	3.5	2.7	3.1
Alumina	0.9	2.0	1.1	1.9	2.2
Iron oxide	4.7	4.3	7.9	4.5	2.8
Manganese oxide	1.4	1.0	...	1.0	0.7
Calcium oxide	1.1	2.3	1.8	2.7	1.1
Magnesium oxide	83.7	85.0	85.5	87.3	90.1
Absorption of water	12.2	7.3	11.0	5.4	8.7
Porosity	26.5	19.3	27.4	15.8	22.4
Specific weight	3.55	3.57	3.56	3.58	3.55
Volume per unit weight	2.18	2.64	2.49	2.92	2.57
Softening—					
Beginning deg. C.	1350	1350	1410	1460	1420
End deg. C.	1390	1390	1540	1520	1450
Range deg. C.	40	40	130	60	30
Maximum value of the expansion	0.5	0.6	1.4	1.1	1.0
Total expansion at 1300 degrees C in per cent	1.28	1.29	....	1.83	1.93
Compressive strength in cold kg./cm.²	98	....	....	723	....
Compressive strength in hot at 1200 deg. C. kg./cm.²	89	....	....	513	....

The magnesites that are described in tabulation number 1 are characterized by their low magnesia content for the most part. These magnesites do not behave very favorably in the pressure softening tests.

The destruction of the sample under a pressure of less than two kilograms, that is the rapid breaking of the sample—often the entire sample of the rock will be totally destroyed in the pressure tests,—takes place between a temperature of 1390 and 1540 degrees C. The first type of magnesite, which is being considered here and which contains a small amount of magnesia and at the same time considerable proportions of silica and iron oxide, shows only a slight elongation and due to the loose structure of the rock the strength in compression is only very small. Tests were also made to determine the rate at which the rock will wear away, these experiments being carried out on a standard grinding machine. These magnesites were also very rapidly worn away. It is noticed that the strength in compression was determined both in the cold and in the hot state, and the latter experiment at a temperature of 1200 degrees C was carried out in a special apparatus. The trouble is undoubtedly that these magnesites have not been properly prepared and burnt.

Additional results obtained with another series of magnesies are given in the following tabulation.

TABULATION No. 2

Designation	IVa	IVb	IVc	IVe	IVf
Analysis					
Insoluble in acid	trace	...	0.1	0.1	trace
Soluble in acid					
Silica	2.3	0.8	0.9	1.9	2.2
Alumina	0.2	0.3	1.6	0.6	0.9
Iron oxide	8.6	8.2	6.9	7.4	6.7
Manganese oxide	0.4	0.5	0.7	0.5	0.7
Calcium oxide	2.1	2.3	1.8	0.9	0.4
Magnesium oxide	86.4	87.1	88.0	88.6	89.1
Absorption of water	5.9	6.8	5.9	9.4	10.2
Porosity	17.0	19.6	17.0	25.7	27.6
Specific gravity	3.63	3.65	3.60	3.56	3.59
Volume per unit weight	2.89	2.88	2.88	2.73	2.71
Softening of the sample—					
Beginning deg. C.	1480	1450	1680	1480	1480
End deg. C.	1650	1500	+1800	1650	1700
Range deg. C.	170	50	?	170	220
Maximum value of elongation	0.9	1.1	1.6	1.4	0.9
Total elongation at 1300 deg. C. in per cent	...	...	2.14	1.83	2.17
Wearability in cu. cms. per sq. centimeter	0.56	0.46	0.60	0.36	0.56
Compressive strength cold in kgs. per sq. cm.	958	...	885	353	390
Compressive strength at 1200 deg. in kgs./sq. cm.	430	...	565	368	240

The magnesites that are described in tabulation number 2 are rocks of good commercial properties. They contain high contents of iron oxide and also comparatively high proportions of magnesium oxide. As the magnesium oxide content increases, the proportion of iron decreases. The specific weight and the weight per unit volume are comparatively greater in this group than in the group of rocks shown in tabulation No. 1. The wearing qualities of the rocks are good, and the strength in compression is also satisfactory. The reduction in the strength of the rock when it is heated is not very large with magnesites. Only in one case did the strength fall markedly to less than half the strength in the cold but even then the strength of the rock under a high temperature was nevertheless good, being as high as 430 kilograms per square centimeter.

The results obtained with magnesites which contain almost one hundred per cent magnesia are given in tabulation No. 3. In one case, in which the magnesia content was only 88.1 per cent, the reason for the low magnesia content was found to

*A Contribution from the Clay Industry, Chemical Laboratory.

be the presence of some foreign matter, that is silica. The group designation IX includes the properties of molten magnesia. Molten magnesia has great hardness and strength and it is almost impervious. The pressure softening apparatus, which was available for testing purposes in the laboratory, did not allow the temperature to be increased high enough so that the molten magnesia entirely melted. Softening started at a temperature of 1790 degrees C. It is also noticed that the elongation or expansion tests with molten magnesia gave the highest results of all, and it was also established that molten magnesia is sensitive to temperature change.

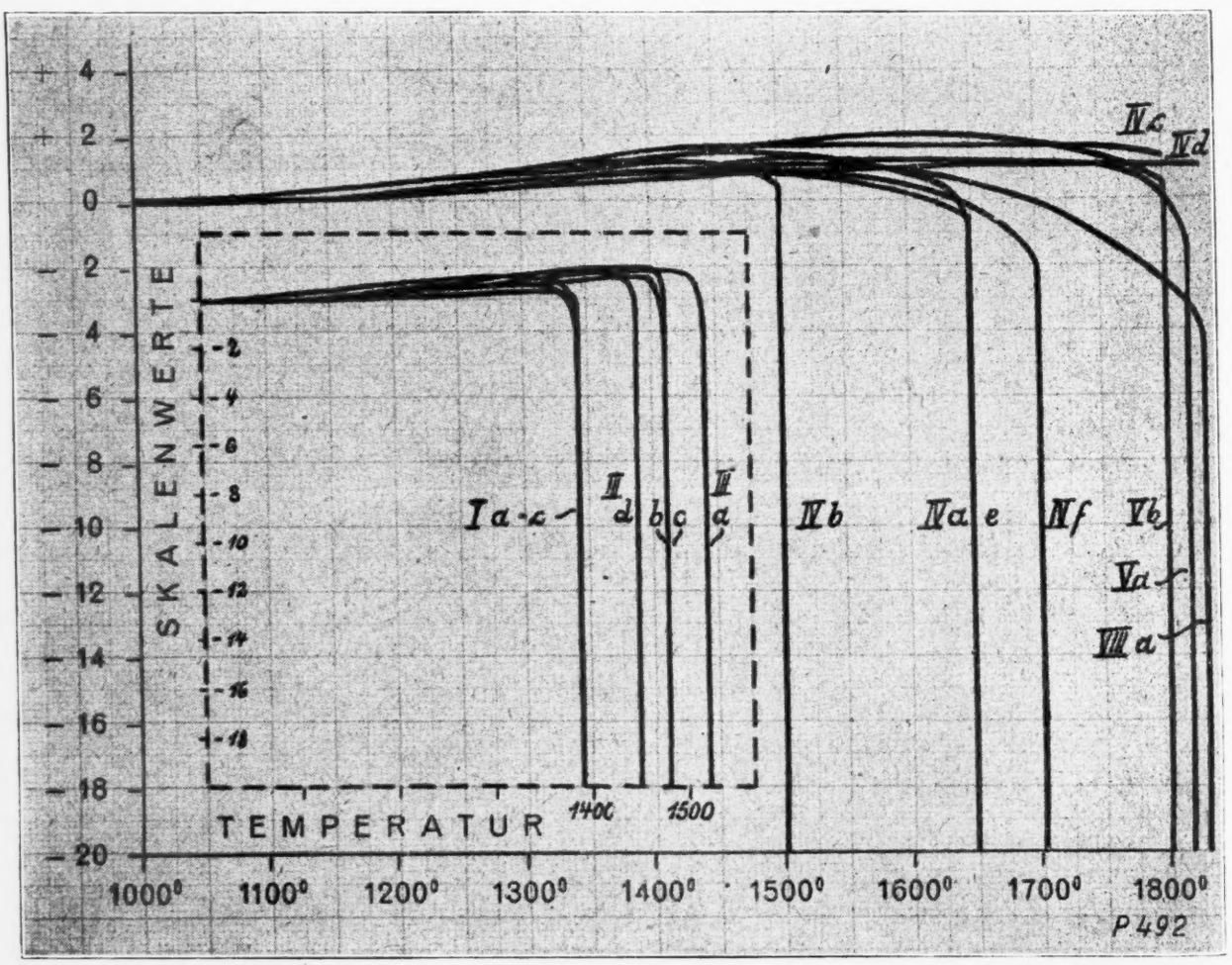
TABULATION No. 3

Designation	Va	VIa	VIId	VIIIa	IXa
Analysis:					
Insoluble in acid	0.1	...	0.2	0.2	0.1
Soluble in acid:					
Silica	1.5	9.0	3.0	1.7	0.6
Alumina	1.1	1.3	0.4	0.5	0.5
Iron oxide	4.9	0.2	0.9	1.6	0.7
Manganese oxide	0.8	...	...	0.6	0.3
Calcium oxide	0.6	1.4	2.2	trace	...
Magnesium oxide	91.0	88.1	93.1	95.4	97.6
Absorption of water	8.1	7.9	7.1	9.8	almost
Porosity	21.6	....	18.4	25.3	impervious
Specific gravity	3.58	....	3.58	3.54	3.62
Volume per unit weight ..	2.67	....	2.59	2.58	3.47
Softening:					
Beginning deg. C. 1640		1560	1450	1510	+1790
End deg. C. 1820		1625	1500	1830	?
Range deg. C. 180		65	50	320	?
Maximum value of elongation	1.3	1.5	1.1	1.1	(1.5)
Total elongation at 1300 deg. C. in per cent	1.70	....	1.79	1.88	2.10
Wear in cu. cms. per sq. centimeter	0.58	....	0.91	1.21	....
Compressive strength in cold in kgs. per sq. cm.	540	332	218	288	...
Compressive strength in hot in kgs. per sq. cm.	523	...	170	267	...

It follows from the figures given in the above tabulation that these more pure magnesite do not soften until the temperature has reached rather high limits, on the assumption that the structure and the strength are satisfactory. It is understood that in addition to the chemical and the mineralogical make-up of the magnesite the method of preparation, the preliminary burning, the size of particles, the pressing and the burning all have an important influence on the softening point of the rock. Thus it has been possible to take a magnesite which did not possess a satisfactory softening point at the outset and raise its softening temperature by as much as 140 degrees C by subjecting it to a high temperature burning.

From the large number of experiments that have been carried out on magnesites, it has been possible to obtain results which were arranged in groups and to draw conclusion from these results relating to the connections that exist between the chemical and physical properties. Variations, which are conditioned by the method of manufacture, are therefore recognized and taken into consideration.

The nine different groups of magnesites which have been described above in tabulations Nos. 1, 2 and 3 can be divided up into three systems in accordance with the iron oxide content. When this is done there will be seen to be similarities both



with respect to the pressure softening properties and also other properties of the rocks. Three such classifications are made, containing first those magnesites that have an iron oxide content of greater than seven per cent, second between three and seven per cent iron oxide and third under three per cent. Figure 1 shows the results obtained with the various groups of magnesite that have been characterized above.

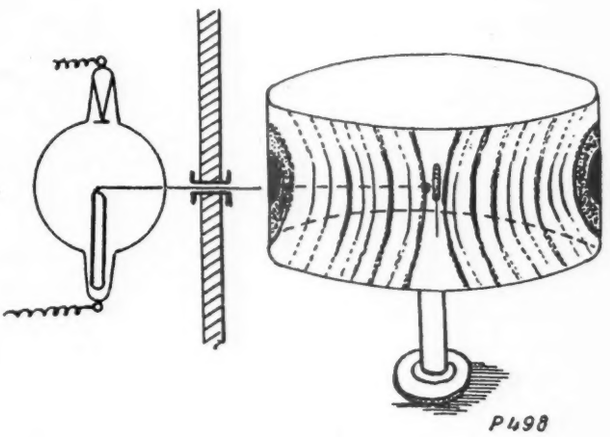
It is seen that in the case of the three groups I, III and V, which contain an average iron oxide content, the curvature of the curves is less. Initial softening takes place in the case of group V magnesites and at higher temperatures softening itself occurs. The curvature of the curves is also slight in the portion that represents magnesites that are poor in iron oxide. This is with the exception of group VIII magnesites whose curves are sharp and which show only slight sintering action.

The following tabulation, No. 4, contains interesting information on the various groups of magnesites, and the average values of the various properties of the magnesites belonging to each group are indicated. The temperatures which are given in parentheses alongside the numbers of the groups denote those temperatures corresponding to the complete softening of the samples of magnesite. In the final column of this tabulation information is found regarding the sensitivity to temperature change. This sensitivity is however designated only as great and very great, for the reason that up to the present time no magnesite has been found which is actually resistant to the effects of temperature.

TABULATION No. 4

	Deg. C.	MgO Per Cent	Specific Gravity	Vol. per Unit Wt.	Total Expansion at 1300 Deg. C. Per Cent	Absorption of Water Per Cent	Porosity Per Cent	Wear in cu. cm. per sq. cm.	Sensitivity to Temperature
Iron oxide over 7 per cent									
Group II	(1515)	84.2	3.56	2.49	...	11.0	27.4	....	very great
Group IV	(1725)	87.9	3.61	2.82	2.0	7.6	21.3	0.5	great
Iron oxide 7 to 3 per cent									
Group I	(1390)	84.8	3.57	2.46	1.3	8.9	21.5	....	very great
Group III	(1480)	88.4	3.57	2.72	1.8	6.9	18.8	0.51	very great
Group V	(1810)	91.0	3.58	2.67	1.7	8.1	21.6	0.58	very great
Iron oxide under 3 per cent									
Group VI	(1710)	88.9	....	....	...	7.9	....	....	very great
Group VII	(1500)	92.8	3.48	2.58	1.8	8.8	22.9	0.85	very great
Group VIII	(1830)	95.4	3.54	2.58	...	9.8	25.3	1.21	great
Group IV	(+1830)	97.7	3.62	3.44	2.0	almost impervious	..	slight	very great

Of the two groups of magnesites which belong to those with a large percentage of iron, the presence of silica in addition to the iron in group II and particularly the insufficient processing of the stone produce a small volume per unit weight and a high degree of porosity. Group IV shows that when the magnesium oxide content of the magnesite is only moderate, the presence of a high percentage of iron oxide is most advantageous. When the magnesite is properly processed, it is possible to obtain a product which is quite resistant to temperature changes. Group I in the classification of three to seven per cent iron oxide is particularly wanting due to the poor processing to which it is subjected. In the case of group III the presence of various



sintering materials and fluxes impair the otherwise favorable character of the magnesite. Group V is the best in this system and is partially better than group IV, for the reason that the higher percentage of magnesium oxide present in the magnesites and the small proportions of sintering materials are combined with better processing of the rock. In this classification which contains those magnesites with low iron oxide content, it has been found, as far as could be concluded from observation, that there is quite some difficulty avoiding the production of a magnesite product which is friable. It is most noteworthy that the products belonging to group VIII, in which molten magnesia is included, are most favorable comparatively speaking, and this refers particularly to the resistance of the stone to changes in temperature. Group VI is more stable than group VI in spite of its higher silica content, but the rocks belonging to this group are also affected by friability.

(The author also describes a number of tests made with the aid of X-ray apparatus to determine the character and behavior of the crystalline structure of the magnesite products.)

Increase in machinery processes and labor efficiency is held to be in a measure responsible for some unemployment throughout the United States. On the other hand economists assert that added individual productiveness tends both to increase national prosperity and to elevate the standard of living of the workers.

QUARRYING AND REFINING ZONOLITE

ZONOLITE, which is said to be a mineral marvel, is produced by the Zonolite Company of Libby, Montana, which owns the only commercial deposit of this mineral now known to exist. It is a non-metallic mineral composed of silica magnesia and alumina. In physical appearance, it is similar to phylogopite mica, dark brown to black in color, and weighing 100 pounds to the cubic foot after mining.

When this apparently inert mineral is subjected to heat of a sufficient degree, it expands to several times its original volume and, dependent upon its texture, varies in weight from six to 20 pounds per cubic foot. Heat causes it to take a gold-bronze color and it may be refined in silver or platinum colors by different methods of heat treating.

The Zonolite Company has experimented for a number of years in developing proper heat treating processes and efficient grinding and screening facilities. A number of manufacturers and chemical engineers have proved Zonolite to be a superior mineral and it is being fabricated or used by many large manufacturers in different lines of endeavor.

Zonolite is being used as a fireproofing material for packing safes, filing cabinets, and bank vaults; as a decorative material for wall paper; as a wall or acoustical plaster; in wall or mill board; in electrical installations; in oil refinery processes; and as a substitute for cork in house and refrigeration insulations. It is used to a limited degree in the manufacture of kalsomine and paint and as a base for lubricants; in boiler and pipe coverings and for many similar purposes.

In some of the applications of Zonolite, a binder is necessary. Experiments have developed the materials which serve as binders and produce strong light weight products for numerous uses. In its expanded form Zonolite is insoluble, vermin proof, lighter than cork, unaffected by weather and fireproof up to 2500 degrees Fahrenheit.

Zonolite was discovered in the spring of 1916 by E. N. Alley, a mining engineer, who was prospecting for molybdenum and vanadium in the Kotenai valley, near Libby. He was examining a quartz stringer in an old tunnel when he heard a crackling, sputtering sound and observed a leaf of mineral swelling in a peculiar fashion above the candle which he had stuck in the wall of the tunnel. He carried some of the substance home and put it on the cook stove and in the fire. It did not burn but swelled to many times its original size and turned gold color. It resembled gold nuggets but was light as a feather, from which action it was known for some time as "feather gold."

Mr. Alley made further tests of the mineral and referred it to a number of research associations, chemists and manufacturers and as a result of these tests a variety of uses were suggested for the material. In 1922 he associated with some New York men to form the Zonolite Company which built a four ton demonstrating plant at Libby. During that time heating and grinding processes were being perfected, a market was being developed and the necessity for a larger plant was apparent. The company constructed a plant with a capacity of 100 tons per day which was ready for operation January, 1927.

Zonolite is mined at a reasonable expense by the caving system and the costs will be further reduced by the installation of a projected aerial tram. The mineral may then be worked off from the grass roots with drag lines and the tram will reduce haulage costs.

The plant now in operation turns out a product ranging from furnace run and lump to as fine as that passing a 100 mesh screen. In milling, the Zonolite is fed to a 5 foot in diameter by 50 foot long rotary kiln by a screw conveyor. The kiln is lined with four ledges of end wedge fire brick which were constructed the full length of the kiln to facilitate exposure to the heat during the passage of the Zonolite. The heat is developed to 1500 degrees Fahr. by a Ray oil burner, introduced at the lower end of the kiln and drawn through with a stack draft.

After passing through a hammer mill, the product is conveyed to a Williams crusher and pulverizer mill of the BX special type which is direct connected to a 40 h. p. motor running at 3400 r.p.m. It passes through an air separator and is conveyed to a cyclone at the top of the plant. It passes by gravity to the receiving bins which discharge into Rotex screens where it is sieved to the desired fineness. It is then transported to the storage bins to be sacked for shipment as required.

In 1924, C. L. Emmons, well known in oil and mining circles in the Northwest, invested heavily in the company. He was elected president in January, 1927, and reelected this year. Mr. Alley, as vice-president and general manager, has active charge of the operations. Although this is, as yet, an infant industry, it is believed that no less than $100,000 has been expended in mine development, plant construction and other improvements incident to its present commercial basis.

The Zonolite Company, it is stated, is not contemplating entering the manufacturing field, preferring rather to produce the raw screened and sized material. Six plants, in various parts of the country, engaged exclusively in the manufacture of Zonolite products are in operation. A seventh is about to be erected on the Pacific Coast for the manufacture of mineral lumber on a large scale.

ACTION OF SLAG UNDER HIGH TEMPERATURES*

AMONG the numerous tests which have been carried out to establish the degree of fire resistance and thermo-conductivity of blast furnace slag, many were on concrete columns, walls and floors. One of the earliest tests, using slag, was conducted by the British Fire Prevention Committee in 1906 to determine the effect of fire on a floor composed of seven equal sections of concrete, the same in every respect except the character of the aggregates and the composition of the mixture. The floor was loaded with a weight of 224 pounds per square foot and the fire which was continuous for three hours, maintained a temperature between 1000 and 2200 degrees Fahr. which was followed by the application of a hose stream of water of 60 pounds pressure to the under side of the floor for two minutes. The slag concrete section showed less buckling than the other sections, excepting the coke breeze concrete which was in better condition.

The Commission then made the most comprehensive tests yet undertaken on 92 plain concrete slabs made with different aggregates which included 2 blast furnace slags, 2 pan breezes, 2 coke breezes, 3 coal clinkers, 4 limestones, 5 bricks, 6 gravels, 7 sandstones and 11 granites and included 67 reinforced concrete slabs.

The fire test varied from three to four hours; the water test from two to five minutes; and the superimposed load varied from 224 to 280 pounds per square foot. The commission concluded that coarse aggregates of clean broken bricks and burnt clays gave the most satisfactory results, but blast furnace slags appeared to be almost as good. The coarse aggregates which did not attain to 1200 degrees Fahr. were slag, limestone basalt, andesite, coke breeze, broken brick and whinstone.

The standard four hour fire test was made on reinforced concrete columns in the testing laboratory of the United States Bureau of Standards. Small specimens, 8 inches in diameter and 16 inches long, were first used on which Walter H. Hull concludes in his report that indications were somewhat favorable to slag and particularly to limestone concrete, but the findings should not be taken as conclusive evidence. Columns 18 inches in diameter and 8 feet 9 inches long were kept under a working load up to 600,000 pounds during the four hour fire test and if they stood up under the load they were cooled and tested in the 10,000,000 pound machine. The results, according to Mr. Hull, contribute additional evidence that gravels high in quartz gave less satisfactory results under fire conditions than concretes from limestone, trap rock and blast furnace slag aggregates. Columns from trap rock and blast furnace slag concrete showed no tendency to crack or spall to any extent under the standard four hour fire test and in all cases, they have been capable of bearing considerably more than twice their working loads, before cooling following the four hour fire test.

Tests were conducted on building units at the Underwriters Laboratory, Chicago, in which the concrete blocks were assembled in the form of panels, which were subjected to the standard fire test for five hours with a maximum of 2200 degrees Fahr. From this test, it is pointed out that fire endurance, fire hose steam, impact, absorption and compressive strength tests show that one piece 5 by 8 by 12 or 8 by 8 by 16 hollow concrete building units having cement proportions from 1:3 to 1:7 of crushed slag, cinders, or sand and calcarous pebbles are capable of withstanding standard fire exposure conditions in excess of five hours without serious bulging, spalling or dislodgment and without permitting passage of flame, radiant heat or smoke through the wall or partition assembly.

Dr. Kurt Endell of Germany came to similar conclusions as Walter Hull after conducting tests on concretes with blast furnace slag, granite, basalt, limestone, quartz and burnt brick, with the specimens heated to 1830 degrees Fahr. Practical results of his investigations show that for heat resisting structures such as smoke stacks and waste heat apparatus, quartz mixtures should not be used, but aggregates composed of basalt, blast furnace slag and limestone should be employed because of their slow and uniform expansion.

Additional fire tests made in Germany were reported by Dr. A. Guttman who has decided that walls built of slag stones exhibited extraordinary resistance to high temperature. Slag stones which had a crushing strength of 2,840 pounds per square inch were subjected to a strong furnace heat for 10 minutes. Some of the stones were suddenly cooled with water and put through a crushing test and the remainder were tested without being chilled. The former showed a strength of 1,846 pounds per square inch and the latter 2,840 pounds per square inch, showing that the high temperature had not hurt the stones, but although the drenching had reduced their strength, they could satisfy strict requirements. From his tests for heat conductivity, Dr. Guttman concludes that slag stones afford greater protection from fire than ordinary back wall bricks and from tests on artificial pumice, a ground slag product, he concludes that the heat conducting degree of artificial pumice is only slightly higher than cork.

The symposium is replete with descriptions of tests in all parts of the world and gives the location of buildings which were exposed to intense heat together with the dimensions of different slag

*Abstract of Symposium No. 3, of a collection of data pertaining to the characteristics and uses of blast furnace slag, prepared by the National Slag Association for presentation to its members.

concrete chimneys as well as the heat resisting ability of slag concrete brick and slag wool. It concludes with a final clincher, which is an excerpt taken from a textbook, "Blast Furnace Slag," published by the Carnegie Steel Company:

"Blast furnace slag resists fire because it has already gone through the fire of the furnace; it is therefore on that score most suitable for use as an aggregate in concrete for fireproof building construction. Subjected to a temperature as high as 2600 degrees Fahr., slag is calcined in the making, and is practically free from gases such as might be given off by limestone, gravel, or other sedimentary rock fragments when used as an aggregate and exposed to fire. The intense heat which frees the slag of water and gas also frees it from any organic and deleterious matter, and thus insures a perfect fire-resistant product which adds materially to the value of concrete used in fireproof construction."

April Construction Breaks Record

April construction contracts in the territory east of the Rocky Mountains broke all previous monthly records, according to F. W. Dodge Corporation. Building and engineering work contracted for last month in the 37 Eastern States (about 91 per cent of the total country) amounted to $643,137,100. August, 1925, March, 1926, August, 1926, March, 1927, April, 1927, and June, 1927, are the only other months on record showing as much as 600 million dollars for construction contracts. June of last year held the previous high record of $632,478,000. The April increase over March of this year was 9 per cent; over April of last year 6 per cent.

Last month's contract total made another record. It brought the amount of new construction work started in these states since the first of this year up to $2,128,204,100, which is the largest total on record for the first four months of any year. The increase over the first four months of last year was 6 per cent.

Analysis of the April building and engineering record showed the following important classes of work: $276,586,200, or 43 per cent of all construction, for residential buildings; $117,401,000, or 18 per cent, for public works and utilities; $85,093,400, or 13 per cent, for industrial projects; $82,757,700, or 13 per cent, for commercial buildings; and $32,885,400, or 5 per cent, for educational projects.

New work planned in the 37 Eastern States during the past month reached a total of $831,496,400, being a drop of 6 per cent from the amount reported in the preceding month and a loss of 4 per cent from the amount reported in April of last year.

How States Rank in Mineral Production

Pennsylvania, with its tremendous output of coal, continues to lead all the states of the Union in the production of minerals, according to a tabulation just made public by the United States Bureau of Mines, Department of Commerce. In addition to coal, cement, clay products and natural gas contributed heavily to the Keystone State's mineral production amounting to $1,055,766,000 in the year 1926. Petroleum is mainly responsible for the attainment of second, third and fourth places by the states of Oklahoma, California and Texas. Oklahoma's production of $569,519,000 was also heavily contributed to by natural gas and zinc. Natural gas and cement were considerable factors in California's output of $523,352,000, while sulphur and natural gas swelled the Texas state total of $420,587,000.

The eastern states of West Virginia, Ohio and Illinois, all large coal producers, ranked fifth, sixth and seventh, with the item of clay products outranking coal in the Ohio production. Other especially notable mineral producing states were Kansas, Kentucky, Michigan, Indiana, Minnesota, Arizona and New York. Every state is included in the list of mineral producers. A detailed tabulation follows:

MINERAL PRODUCTION OF THE DIFFERENT STATES, 1926

State	Principal Mineral Products	Amount
Pennsylvania	Coal, cement, clay products, natural gas	$1,055,766,000
Oklahoma	Petroleum, natural gas, zinc	569,519,000
California	Petroleum, natural gas, cement	523,352,000
Texas	Petroleum, sulphur, natural gas	420,587,000
West Virginia	Coal, natural gas, petroleum, clay products	395,942,000
Ohio	Clay products, coal, natural gas, petroleum	253,884,000
Illinois	Coal, clay products, petroleum, cement	237,242,000
Kansas	Petroleum, zinc, natural gas, coal	165,061,000
Kentucky	Coal, petroleum, clay products, natural gas	146,768,000
Michigan	Iron ore, copper, cement, salt	130,861,000
Indiana	Coal, cement, stone, clay products	118,692,000
Minnesota	Iron ore, stone, cement, clay products	118,361,000
Arizona	Copper, gold, silver, lead	115,048,000
New York	Clay products, gypsum, cement, stone	112,016,000
Utah	Copper, lead, silver, coal	98,985,000
Missouri	Lead, clay products, cement, coal	90,004,000
Arkansas	Petroleum, natural gas, coal	84,486,000
Alabama	Coal, iron ore, cement, clay products	83,710,000
Montana	Copper, zinc, petroleum, silver	79,763,000
Wyoming	Petroleum, coal, natural gas	78,988,000
New Jersey	Clay products, zinc, cement, stone	77,066,000
Colorado	Coal, gold, lead, petroleum	65,597,000
Louisiana	Petroleum, natural gas, sulphur	62,204,000
Virginia	Coal, clay products, stone, cement	46,136,000
Tennessee	Coal, cement, clay products, stone	39,297,000
Iowa	Coal, cement, gypsum, clay products	35,972,000
Idaho	Lead, silver, zinc, stone	31,753,000
New Mexico	Copper, coal, petroleum, zinc	28,514,000
Nevada	Copper, silver, gold, lead	27,613,000
Maryland	Coal, clay products, cement, sand and gravel	24,067,000
Washington	Coal, cement, clay products, sand and gravel	21,257,000
Wisconsin	Stone, zinc, sand and gravel, iron ore	20,712,000
Florida	Phosphate rock, stone, sand, gravel, fuller's earth	19,752,000
Alaska	Copper, gold, coal, silver	17,607,000
Georgia	Clay products, stone, cement, fuller's earth	17,480,000
Massachusetts	Stone, clay products, sand and gravel, lime	16,787,000
Vermont	Stone, slate, lime, talc	14,955,000
North Carolina	Clay products, stone, sand, gravel, feldspar	10,993,000
Connecticut	Clay products, stone, lime, sand and gravel	7,695,000
South Dakota	Gold, cement, stone, sand and gravel	7,595,000
Oregon	Stone, cement, sand and gravel, clay products	6,941,000
Maine	Stone, lime, slate, clay products	5,786,000
New Hampshire	Stone, clay products, sand, gravel, feldspar	4,145,000
South Carolina	Clay products, stone, sand, gravel, barite	3,677,000
Nebraska	Clay products, sand and gravel, cement, stone	3,322,000
North Dakota	Coal, sand and gravel, clay products	2,805,000
Mississippi	Clay products, sand and gravel, stone	1,883,000
Rhode Island	Stone, clay products, sand and gravel, lime	1,339,000
Dist. of Col.	Sand and gravel, clay products, sand-lime brick, stone	987,000
Delaware	Stone, clay products, sand and gravel	378,000

PIT AND QUARRY FOREIGN DIGEST

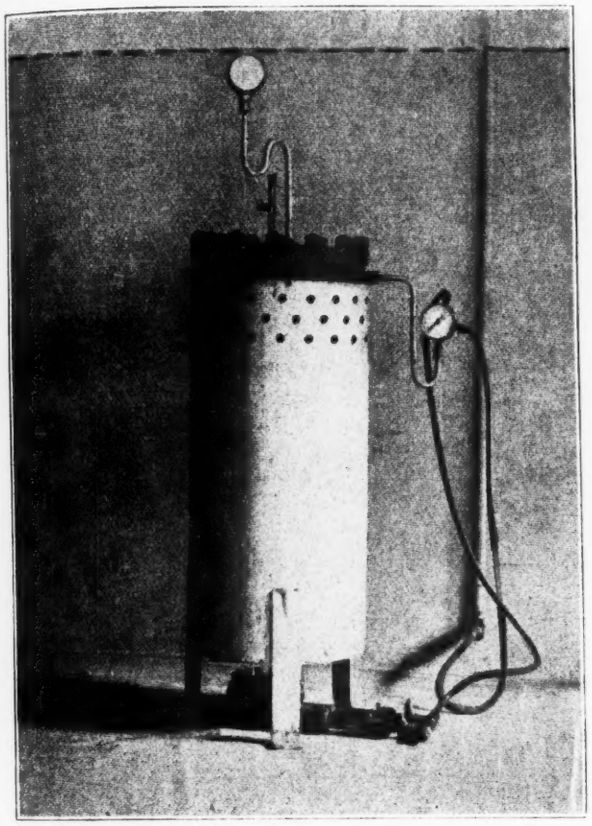


Figure 1

Accelerated Cement-Testing

The 28-day strength of standard test pieces of cement can be determined at the end of two days by making use of "steam hardening." The autoclave, shown in Figure 1, is one-quarter filled wth water. Above the water level is a perforated steel disc upon which the test pieces are placed. The apparatus is then heated until the steam pressure reaches 24 atmospheres (360 lbs. per sq. in.) and maintained at this point for 24 hours. At the end of this time the pressure is released, the pieces removed, dried and subjected to the usual tensile and compressive strength tests which correspond closely to those of the same cement mixtures taken after 28 days water or combination curing. It has been determined that (1) the strength of a cement when tested by high pressure steam, up to a certain extent is a function of the pressure, temperature and time of exposure. (2) Both for the duration and the degree of pressure (temperature) there is a maximum strength, which decreases if the optima are exceeded. (3) Twenty-eight day strength may be approximated by using proper steam pressures and time of exposure. Dr. Karl Biehl (Zement, April 19, 1928).

Blast Furnace Cement

A new German official definition of blast furnace cement is as follows: It is a hydraulic mortar which contains from 15 to 69% by weight of basic blast furnace slag, which is grained by the sudden cooling of the molten slag. The balance is Portland Cement. The two are finely ground together and intimately mixed. The slag used must have a composition corresponding to:

$$\frac{CaO+MgO+1/3\ Al_2O_3}{SiO_2+2/3\ Al_2O_3} > 1$$

The slag must not contain more than 5 per cent water. The Portland cement ingredient must equal the standards for this cement. Additions for special purposes, as, for instance, to regulate the setting time are limited to 3 per cent of the total weight. (Zement, April 19, 1928).

Estimating Aluminum

The separation of aluminum by means of hydroxyquinoline in acetic acid solution, possesses the advantage over other methods, that the aluminum precipitate is crystalline and free from other compounds, which might be expected to precipitate. The precipitated quinolate makes possible the rapid bromometric determination of aluminum, even of the smallest amounts. Von R. Berg (Zeit. f. analyt. Chem. 71., pp. 369-380).

Shaft Kiln for Burning Lime or Cement

The kiln (Figure 2) has a preheating zone C, into which the raw materials are charged from the hopper A, by means of the revolving device B. Carbon dioxide is driven off in the preheating zone. The firing is done below the "acid removal" zone by means of gas, coal dust or fuel oil. The preheating zone is heated by radiant energy, the burning & sintering zone by direct heat. Below the sintering zone the side walls are made in zigzag form, and there is a central wall, also zigzag, the burned goods falling through these irregular passages to the outlet. E. Meier (German Patent Application 94, 454).

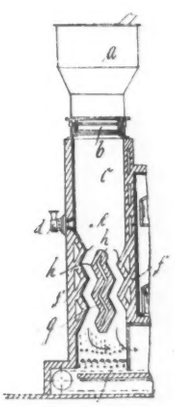


Figure 2

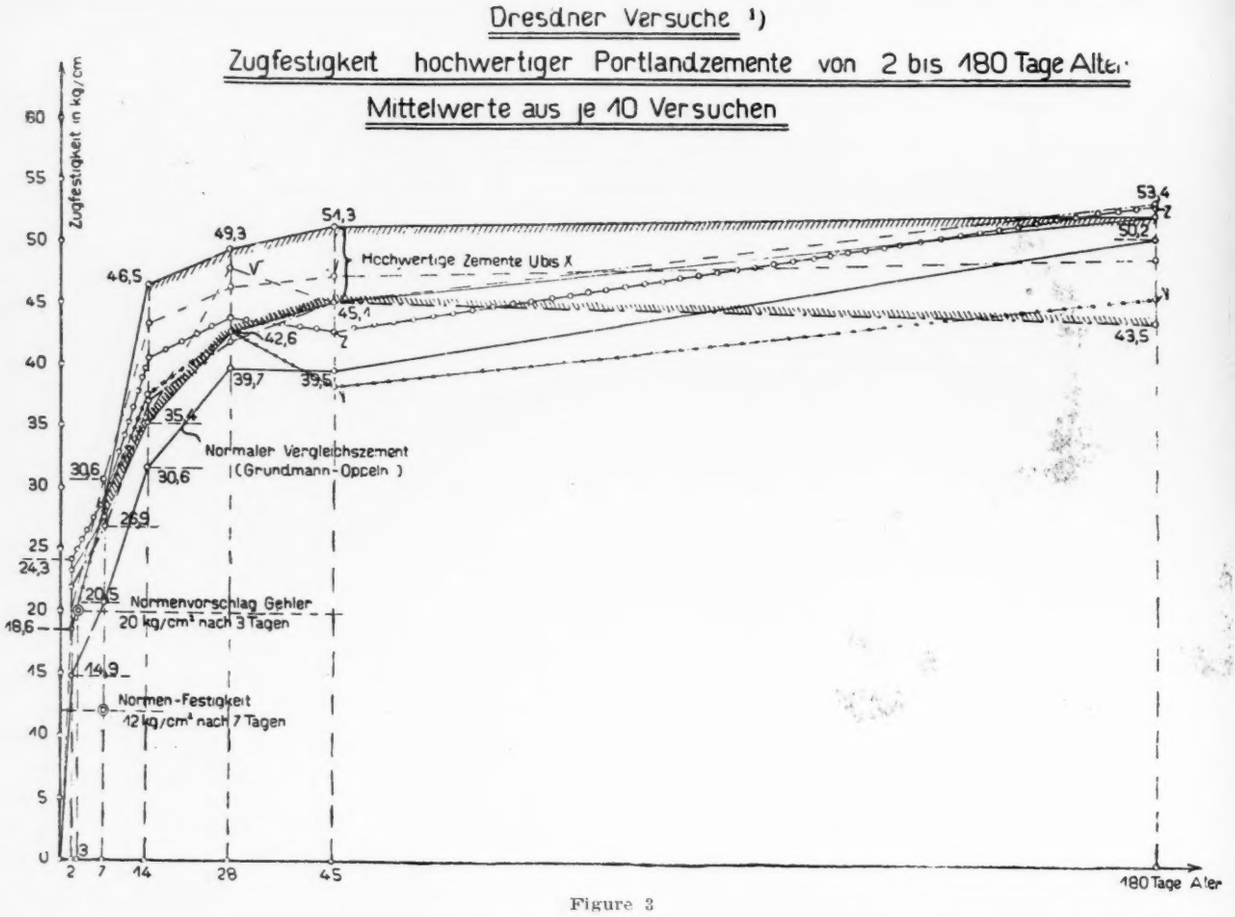

Dresdner Versuche 1)
Zugfestigkeit hochwertiger Portlandzemente von 2 bis 180 Tage Alter
Mittelwerte aus je 10 Versuchen
Zugfestigkeit in kg/cm
Hochwertige Zemente Ubis X
Normaler Vergleichszement (Grundmann-Oppeln)
Normenvorschlag Gehler 20 kg/cm² nach 3 Tagen
Normen-Festigkeit 12 kg/cm² nach 7 Tagen
180 Tage Alter

Figure 3

Water Addition to Standard Cement

The water additions according to the hammer scale between 90 and 110 appeared to need revision. The following are proposed:

(a) $\frac{W}{4}$; (b) $\frac{W}{4} + \frac{1}{4}$ of $\frac{W}{4}$; (c) $\frac{W}{4} + \frac{1}{2}$ of $\frac{W}{4}$

W is the water addition, which a cement without sand requires in order to exhibit normal consistency when measured in the Vicat apparatus. Cae (a) is designated "earth damp," (b) "just workable," and (c) "plastic." The best curing for a 14 day cure was found to be 1 day in damp "box," 1 day in water, and 12 days in the air. A new method of testing cement by its reaction to the amount of setting water added shows promise. Studies should be made on the effects of the very smallest variations of the setting water added on all properties of cement; tests on kiln drying; on the influence of altered forms of curing daily and hourly variations of the curing medium should be noted, water, air, and temperature. Studies must also be made on the volume change in conjunction with interior and exterior effect of water. Figure 6 shows that the internal automatic thickening because of the speed of rapid hardening cements, gives a 14 day strength figure satisfactory for strength comparisons. H. Luftschitz (Zement, March 15, 1928).

Burning of Powdered Substances

Na_2CO_3 and $BaSO_4$ begin to react at 550 degrees C., and at 600 this reaction (to form Na_2SO_4 and $BaCO_3$) is quite distinct. These temperatures are much below the eutectic which is 790 degrees. Starting with Na_2SO_4 and $BaCO_3$, the reaction also reverses at 600 degrees, as can be proven by analysis. Well dried salts only were used. Reactions in the solid state (the production of cement is one) occur only if the "lattice mobility" of the material is great. Two substances which liberate heat in reacting, react when heated above the recrystallization temperature. Figure 7, shows at *c* powdered crystalline silica, at *b*, powdered zinc oxide, which was heated 30 minutes at 900 degrees; 7*a* shows a mixture of these two materials after heating at 900. The grain sizes of zinc oxide and silica are increased only slightly in the product, but the heated mass of the two substances are strongly baked together. In practice when burning powdered material (cement, clay, etc.) water is always added. The influence of liquid additions is shown in Figure 8. 8*a* powdered, crystalline silica heated to 1100 degrees, 8*b* silica with 10 per cent benzine, and 8*c* with 10 per cent water added before being burnt at the same temperature. 8*b* and 8*c* have distinctly greater grain sizes than 8*a*. B. Garre (Zement, March 15, 1928).

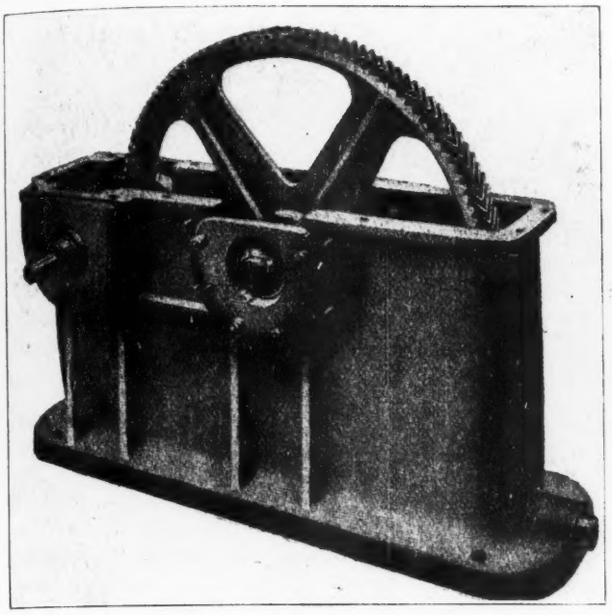


Figure 4

Cement Mill Elements

Machine parts of cement mills and rotary kilns include the following important ones. The speed reducer which operates the drive must have following qualities: High efficiency and silent drive, great durability without wear in operation, ease of dismounting and mounting, simplicity and robustness of construction, absolute tightness to oil and dust, low cost. This type of reducer, the cover lifted, is shown in Figure 3. It is 98-99 per cent efficient and functions silently without vibration no matter what charge is used. A reduction range from 1 to 13 is possible. Reduced speed drives consist of a motor, a transmission, and proper coupling. This coupling must be perfectly elastic circumferentially to absorb the very severe vibrations and shocks caused by the grinding apparatus, and to hinder their transmission either to reducer or the motor. It should be elastic in the direction of the axis, to absorb the floating of the motor and the axial motions caused by the mill. It must also be elastic radially to absorb the inequalities due to errors in mounting, and to the wear on the transmission bearings. Besides, these couplings must possess, like the speed reducers, those qualities appropriate to the rough treatment received in cement plants, easy and rapid demountability, simple maintenance, absence of fragile elements and negligible wear. A coupling which has these qualities is shown in Figures 4 and 5. It is composed of two discs keyed to their shaft and of which the periphery has a number of cut grooves. A tempered spring engages these grooves and its segments form a continuous cylindrical grille. This device is contained in a grease box and constitutes the characteristic principle of the coupling. L. Chanand (Le Ciment, April, 1928).

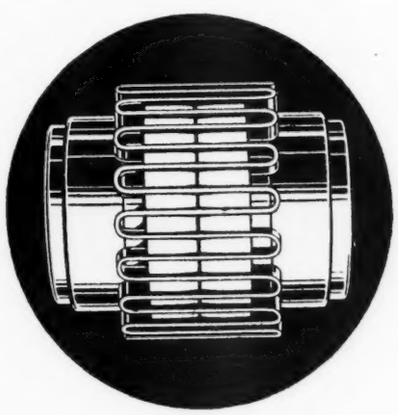


Fig. 2

Figure 5

Porous Building Material

A solidified foam is produced chemically by mixing a mortar either with calcium carbide and a vegetable glue solution, or with aluminum powder and an alkaline soap solution. E. C. Bayer (German patent 453, 265).

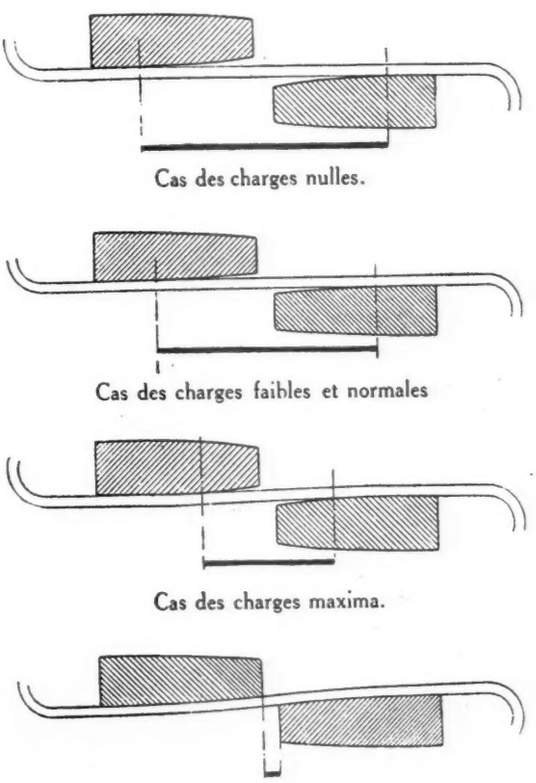


Fig. 3.

Figure 6

Explanation Figure 5

A. Position of spring with no charge.

B. Position of spring with small and normal charges.

C. Position of spring with maximum charge.

D. Position of spring with accidental overload.

Figure 7

Aluminous Cement Used With Ordinary Cements

Aluminous cement in the form of mortar or concrete is introduced into the form in the customary manner by pouring, pressing or tamping, into a layer. This layer is then covered at once with a second layer of ordinary cement which is introduced in similar fashion by pouring, pressing or tamping. Any hydraulic mortar may be used, without waiting for the first layer to set, and without paying any attention to the mixing which will occur at the contact surfaces. Société Anonyme "Lap," Paris (German Patent 455,938).

Magnesia Cement and Its Use

Seventy-five quarts of magnesia, 75 quarts wood flour and 12 pounds iron oxide (pigment) are mixed thoroughly like the aggregate in concrete. One hundred sixty-five pounds of magnesium chloride are then made up to a solution of 22 degrees Baume with water and this solution is mixed with the dry colored powder to a uniform consistency. This mixture is allowed to rest for one-quarter of an hour until the wood particles are exteriorly saturated with the brine. During this time the surface on which the mixture is to be placed is moistened with magnesium chloride solution. After pouring the surface is troweled and is hard after 24 hours. E. Launoy (Le Ciment, April, 1928).

Colors for Cement

Colors for use in cement mixtures should comply with the following conditions: They must be (1) produced with a known chemical composition, (2) free from water, (3) of mineral origin, (4) resistant to light and alkalis, (5) absolutely free from soluble salts, so that, after their use, there will not be produced, sooner or later, efflorescences, cracks, stains, spoiling the surface. They must be (6) absolutely insoluble in water, (7) free from gypsum, for if this is added to the cement mortar in even small quantities splitting of the coating occurs. They must be (8) stable even in the presence of corrosive cements, (9) free from all impurities added to increase their weight or brilliance, and must preserve their fresh color over several decades. They must be (10) ground, to facilitate mixing with the cement and (11) they must cause no decrease in the strength of cement. B. Branner (Tonindustrie Ztg. and Le Ciment, April, 1928).

Bank Failures Decrease

Bank failures in the United States during the first three months of 1928 show a decline of approximately 37 per cent compared with the corresponding period in 1927, it is revealed by an examination of data gathered by R. G. Dun & Co. Banks which have closed their doors this year number as against 174 in 1927.

Nearly 61 per cent of the bank suspensions for 1928 are listed among the states of the Central West—Minnesota, Iowa, Missouri, Nebraska, Kansas and the Dakotas. Iowa reports 17 failures, South Dakota 16, Kansas 14, and the section as a whole 66. The 1927 record in this area was 71 failures.

No banks have failed in the New England states in the first quarter of 1928. In the Middle Atlantic group, comprising New York, New Jersey and Pennsylvania, only one reverse is reported. The Pacific states—Washington, Oregon and California, have suffered too. In all, 27 states of the Union have had no bank failures so far this year.

Liabilities involved in the first-quarter bank insolvencies of 1928 total $36,802,098. This is a decrease of 44.8 per cent.

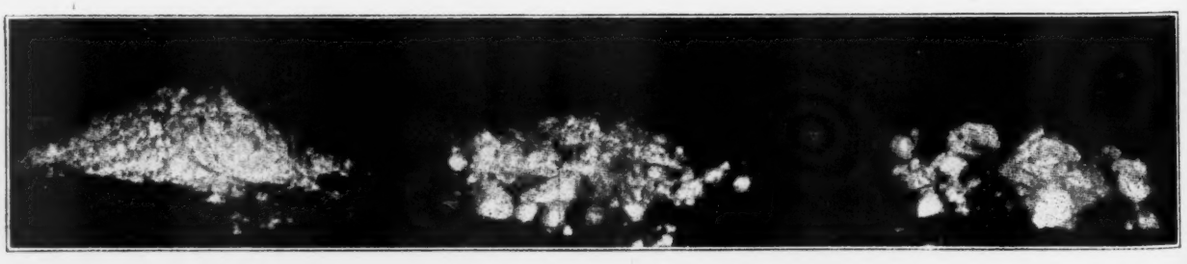


Figure 8

INTIMATE NEWS OF MEN AND PLANTS

Davison Chemical Acquires Southern Phosphate

The Davison Chemical Company of Baltimore has purchased 160,000 shares of stock in the Southern Phosphate Corporation which is the controlling interest of the Florida Company. This gives the Davison Company control of one of the largest phosphate rock deposits in the state, as the Southern Phosphate Corporation produced in excess of 250,000 tons of rock last year from the property which is estimated to contain 23,000,000 tons. This acquisition by the Davison Company, together with the alliance previously made with the Rio Tinto Company for a supply of pyrites, completes its protection for all necessary raw materials, according to information from C. Wilber Miller, president of the Davison Corporation.

Munson Elected President Michigan Limestone

John G. Munson was recently elected president of the Michigan Limestone and Chemical Company and the Bradley Transportation Company at a meeting of the board of directors, to fill the vacancy caused by the death of Carl D. Bradley. Mr. Munson formerly was vice-president and general manager of both companies. James A. Farrell, president of the United States Steel Corporation, has taken the place on the board of directors formerly held by Mr. Bradley. Other officers of both companies are: W. A. Brown, senior vice-president; W. Foster White, secretary; R. B. Henley, assistant secretary and accountant; and J. P. Kinville, treasurer.

Ohio Quarry Enlarges

J. E. Osborn and Son are making extensive improvements to the machinery and equipment of their stone quarry at Belle Center, Ohio. New bins are being erected that will double the storage capacity and a new elevator that will make it possible to produce any size of rock required, is being installed. All improvements will be completed by the first of June.

New Jersey Slate Quarry Resumes Operation

The Lafayette slate quarry of Lafayette, New Jersey, now owned by Louis Hershkowitz of Port Chester, New York, has reopened with Dial Hoskins as superintendent.

New West Virginia Quarry

The Marble Cliffs Quarries Company has ordered machinery for a plant to be erected on Pennsylvania railroad ground near the municipal water plant.

Georgia Granite Quarry Changes Hands

C. S. Cary of Sparta, Georgia, recently purchased a granite quarry near Culverton from J. O. Moore. The new owner expects to work the quarry regularly.

New Louisiana Stone Company

The Wilson-Winfrey Stone Company of Shreveport, Louisiana, has incorporated with a capital of $20,000. The new firm will engage in the buying and selling of stone and other building materials. Officers are: K. C. Wilson, president; L. L. Winfrey, vice president; and H. G. Winfrey, secretary-treasurer.

Dewey Cement Enlarges

The Dewey Portland Cement Company of Davenport, Iowa, plans to add a new unit to its plant at Buffalo, increasing the present daily capacity of 3,000 barrels to 4,500. This enlargement is considered necessary because the plant has been operating at full capacity all winter and the demand for cement is increasing as summer approaches.

California Stone Merger

The Consumers Rock and Gravel Company, and the California Materials, Incorporated, of Los Angeles, recently merged with assets of $6,500,000. The combined yearly output will be 4 million tons of crushed rock and similar products.

Macon County, Illinois, Buys Gravel Pit

A gravel pit was recently purchased by Macon County, Illinois from A. R. Parrish. Gravel taken from this pit, which is located on the Boiling Springs road three miles northwest of Decatur, is being used to renew the surfacing of old roads and to surface new roads.

New California Rock Plant

The Johnston Rock Company located on Butte Creek, three miles southeast of Chico, California, recently completed the construction of one of the largest and most modern plants in the state. It is owned and operated by J. E. Johnston of Chico and will produce crushed rock, sand and gravel. Auxiliary plants are now under construction for the manufacture of cementing road rock and oiled rock surfacing. The total cost of this plant will be approximately $250,000 and the daily capacity 2,000 tons.

New Texas Potash Plant

The American Potash Company of Dallas, Texas, has acquired a tract of land in Midland County where potash is to be mined by means of shafts and underground workings. J. N. Stier and J. B. Adoue, both of Dallas, are officers of the company.

New Texas Gravel Plant

A sand and gravel deposit covering parts of three sections of land, and estimated to be from 100 to 200 feet deep in places, is being worked on land belonging to Elmer Tibbitts, in the northeastern part of Floyd County, Texas. A. B. Brown of Lockney, is in charge of operations and the major part of the output is being used by the Fort Worth and Denver South Plains railroad, whose right of way adjoins the property.

A Concrete Primer

F. R. McMillan, director of research of the Portland Cement Association, at the 24th annual convention of the American Concrete Institute at Philadelphia presented a paper called the "Concrete Primer". This primer describes in simple terms the principles governing concrete mixtures and shows how a knowledge of these principles and of the properties of cement can be applied to the production of permanent structures in concrete. Although no claim is made for completeness of detail this article answers in a satisfactory manner the fundamental questions that may arise in the use of cement.

Indiana Marl Bed Discovered

A marl bed was recently discovered on the farm of Leo Birchler, near Fulda, Indiana, by Geologist F. C. Bratcher of Leitfield, Kentucky, who estimated its value at about $1.50 per ton.

DISTRIBUTION OF CEMENT

The following figures show shipments from Portland cement mills distributed among the States to which cement was shipped during February and March, 1927 and 1928.

Portland cement shipped from mills into States in February and March, 1927 and 1928, in barrels*

Shipped to	February 1927	February 1928	March 1927	March 1928
Alabama	127,020	254,968	141,921	282,379
Alaska	132	928	305	264
Arizona	41,677	72,365	45,602	81,586
Arkansas	59,309	76,288	59,114	101,428
California	649,302	909,617	1,094,778	937,253
Colorado	45,006	33,593	47,912	60,381
Connecticut	58,534	52,401	109,035	113,752
Delaware	13,885	11,304	24,826	19,230
District of Columbia	59,964	55,069	95,396	62,160
Florida	285,604	105,590	290,682	114,798
Georgia	134,787	97,616	169,167	157,171
Hawaii	31,022	26,923	19,615	39,411
Idaho	27,495	11,020	35,047	23,994
Illinois	417,054	401,092	752,148	700,881
Indiana	143,650	102,747	†273,970	232,338
Iowa	55,837	41,520	147,119	149,705
Kansas	107,823	107,291	166,110	194,957
Kentucky	78,183	52,748	†112,435	103,113
Louisiana	122,629	97,484	134,893	115,669
Maine	5,422	10,738	20,132	18,704
Maryland	123,421	66,413	231,780	123,334
Massachusetts	81,457	100,548	193,283	160,730
Michigan	301,666	287,114	†527,829	433,110
Minnesota	61,047	49,334	147,967	128,332
Mississippi	62,783	50,677	75,149	73,937
Missouri	173,365	170,275	287,825	333,221
Montana	9,845	10,578	19,365	27,231
Nebraska	39,594	33,967	81,860	88,491
Nevada	3,649	4,524	7,665	7,568
New Hampshire	9,599	18,066	25,391	25,575
New Jersey	279,739	296,641	611,542	505,016
New Mexico	20,957	21,302	32,564	30,606
New York	855,484	768,681	1,511,091	1,237,218
North Carolina	168,720	100,830	235,316	209,006
North Dakota	3,081	2,641	20,429	18,274
Ohio	321,218	298,885	†585,797	540,347
Oklahoma	191,130	203,245	235,301	294,206
Oregon	53,310	74,793	91,820	78,121
Pennsylvania	476,001	404,956	†865,043	657,006
Porto Rico	1,275	0	2,500	1,329
Rhode Island	19,874	18,701	50,746	47,707
South Carolina	47,821	75,677	71,247	119,612
South Dakota	10,170	10,434	31,724	25,694
Tennessee	102,871	109,112	137,431	174,774
Texas	371,525	383,884	481,261	546,960
Utah	15,527	15,131	25,741	35,955
Vermont	4,472	15,902	9,397	14,737
Virginia	92,723	104,674	124,387	173,697
Washington	124,266	128,568	229,012	162,335
West Virginia	64,296	44,944	†97,094	81,273
Wisconsin	100,245	91,829	221,345	148,969
Wyoming	7,754	8,427	†10,293	13,571
Unspecified	18,914	22,737	†14,749	57,761
	6,682,134	6,514,792	†11,034,151	10,084,877
Foreign countries	48,866	48,208	65,849	50,123
Total shipped from cement plants	6,731,000	6,563,000	†11,100,000	10,135,000

Relation of Production to Capacity

	April 1928 Per cent	April 1927 Per cent	March 1928 Per cent	February 1928 Per cent	January 1928 Per cent
The month	70.0	78.1	51.7	47.5	49.4
The 12 months ended	74.0	76.3	74.6	75.1	74.5

Production, shipments, and stocks of finished Portland cement, by months, in 1927 and 1928 (in thousands of barrels)

Month	Production 1927	Production 1928	Shipments 1927	Shipments 1928	Stocks at end of month 1927	Stocks at end of month 1928
January	8,258	*9,768	5,968	*6,541	22,914	25,116
February	7,377	8,797	6,731	6,563	23,563	27,349
March	11,450	10,223	11,100	10,135	23,922	*27,445
April	14,048	13,468	14,350	13,307	23,654	27,605
May	16,701	.....	16,865	.....	23,503	.....
June	17,224	.....	19,761	.....	20,972	.....
July	17,408	.....	18,984	.....	19,397	.....
August	18,315	.....	21,411	.....	16,292	.....
September	17,505	.....	19,828	.....	13,996	.....
October	17,174	.....	18,105	.....	13,141	.....
November	14,449	.....	11,619	.....	16,022	.....
December	11,999	.....	6,200	.....	*21,924	.....
	171,908	.....	170,922	.....	.....	.....

*Includes estimated distribution of shipments from three plants in February and March, 1928, and in February, 1927; and from five plants in March, 1927.

†Revised.

CEMENT STATISTICS FOR APRIL, 1928

The Portland cement industry in April, 1928, produced 13,468,000 barrels, shipped 13,307,000 barrels from the mills, and had in stock at the end of the month 27,605,000 barrels, according to the United States Bureau of Mines, Department of Commerce. The production of Portland cement in April, 1928, showed a decrease of 4.1 per cent and shipments a decrease of 7.3 per cent, as compared with April, 1927. Portland cement stocks at the mills were 16.7 per cent higher than a year ago. The total production from January to April, 1928, inclusive, amounts to 42,256,000 barrels compared with 41,133,000 barrels in the same period of 1927, and the total shipments from January to April, 1928, inclusive, amounts to 36,446,000 barrels as compared with 38,149,000 barrels in the same period of 1927.

The statistics here presented are compiled from reports for April from all manufacturing plants except two for which estimates have been included in lieu of actual returns. They include the output of another new plant, located in Maine, which began operating during the month.

In the folowing statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 156 plants at the close of April, 1928, and of 143 plants at the close of April, 1927.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20c each. State number of patent and name of inventor when ordering.

1,666,124. Pulverizing-machine. Ernst H. Elzemeyer, St. Louis, Mo., assignor to American Pulverizer Co., same place.

1,667,167. Mining-machine. Charles F. Osgood, Claremont, N. H., assignor to Sullivan Machinery Co.

1,667,337. Gyratory crusher. William S. Weston, Columbia, S. C.

1,667,381. Excavating machine. Olaf Hetlesater, Seattle, Wash.

1,667,690. Sand-gate. Rollie Hamm, Indianapolis, Ind., assignor to Indiana Gravel Co., same place.

1,667,959. Discharge-gate for mortar-mixers. Oliver C. Talbot and Andrew Flood, Kansas City, Mo.

1,668,185. Concrete-mixing machine. George T. Allen, Dunellen, N. J.

1,668,548. Continuous material. Harry E. Brookby, Chicago, Ill., and Charles K. Roos, Fort Dodge, Iowa, assignors to United States Gypsum Co., Chicago.

New Incorporations

Rogers County Stone & Cement Co., Commerce Bldg., Okmulgee, Okla. $50,000. W. T. Bowling, Pres.; W. T. Long, Sec. Plant at Ooologah, Okla.

Cincinnati Sand & Gravel Co., 1014 Mercantile Library Bldg., Cincinnati, O. William Reehl, Harry Donnelly. 16,000 shares.

Wilson-Winfrey Stone Co., Box 226, Shreveport, La. $20,000. K. C. Wilson, Pres.; L. L. Winfrey, V.-P.; H. G. Winfrey, Sec.-Treas.

Loewner Granite & Oil Marble Co., Inc., Harrisburg, Va. $50,000. Charles E. Loewner, Louis F. Davison.

John F. Kleist Sand & Gravel Co., Inc., Milwaukee, Wis. 500 shares at $100 each. J. F. Kleist, Walter Richter, John A. Krause.

Herzog Lime & Stone Co., Forest, O. (formerly John Herzog & Son). 2,500 shares, pfd. $100; 5,500 shares n.p.v. Fred Cramer, J. Del Miller, Bert Herzog.

Hagerstown Granite Co., 227 N. Prospect St., Hagerstown, Md. Donovan R. Beachley.

Cumberland Sand & Gravel Co., Sharonville, O. 200 shares n.p.v. Morris Parker, William H. Boettger, Reva M. Parker.

Rock Quarry Co., Quincy, Mass. $35,000; 350 shares, $100 each. Otto Winquist, John Winquist, Waino Helin.

Muskego Washed Sand & Gravel Co., Muskego, Route 3, Box 100, Waukesha, Wis. 100 shares, $100 each. Harry Dibbert, Warner Stein, Felix Petroske. To quarry sand, stone and gravel.

Fresh Water Sand & Gravel Co., Ltd., Vancouver, B. C., Can. $250,000.

Nelson Island Lime Co., Ltd., Vancouver, B. C., Can. $75,000.

Schubert Brothers, Inc., Granville, N. Y. $25,000. To manufacture roofing slate. L. R. Carpenter.

Sand & Gravel Co., Tama, Ia. $100,000. W. M. Poole, Pres.; W. W. Wilson, Sec'y.

Great Lakes Gravel Co., 1902 First National Bank Bldg., Detroit, Mich. $200,000 pfd.; 20,000 shares at $5.00 each.

Lockport Stone Co., Inc., Lockport, N. Y. $20,000, $100 par value. H. D. Suitor, R. A. Knowles, F. C. Wisbaum, all of Niagara Falls, N. Y.

Marlbrook Lime & Stone Corp., Roanoke, Va. $10,000-$150,000. W. P. Huff, Pres.; I. E. Redmondson, Sec.; C. C. Nelms.

EXPORTS AND IMPORTS

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision

Exports of hydraulic cement by countries in March, 1928

Exported to—	Barrels	Value
Canda	2,205	$ 10,047
Central America	18,318	57,372
Cuba	6,657	19,446
Other West Indies	8,347	18,428
Mexico	7,916	25,311
South America	25,157	97,948
Other countries	6,382	37,163
	74,983	$265,719

Imports of hydraulic cement by countries, and by districts, in March, 1928

Imported from—	District into which imported	Barrels	Value
Belgium	Galveston	16,300	$ 20,459
	Massachusetts	84,431	126,040
	New York	11,085	13,946
	North Carolina	40,000	49,242
	Oregon	6,000	7,238
	Rhode Island	21,828	28,539
	South Carolina	4,362	5,179
	Washington	6,000	8,665
	Total	190,006	$259,308
Canada	St. Lawrence	500	940
Denmark	Porto Rico	33,874	52,697
France	New York	1,290	4,179
Germany	Massachusetts	250	417
Hungary	Philadelphia	10	31
United Kingdom	New York	9,999	12,494
	Ohio	1	8
	Total	10,000	12,502
	Grand total	235,930	$330,074

Exports and imports of hydraulic cement, by months, in 1927 and 1928

Month	Exports				Imports			
	1927		1928		1927		1928	
	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	75,346	$ 254,072	56,400	$204,875	193,175	$ 269,661	234,753	$342,797
February	71,404	233,985	62,828	221,620	130,421	200,680	164,408	217,525
March	67,956	240,165	74,983	265,719	181,145	261,519	235,930	330,074
April	72,383	243,832	.....	.....	191,868	313,262	.....	.....
May	59,332	205,574	.....	.....	178,929	263,618	.....	.....
June	69,205	237,281	.....	.....	129,111	201,682	.....	.....
July	72,337	229,737	.....	.....	175,035	249,665	.....	.....
August	61,371	209,198	.....	.....	117,605	170,167	.....	.....
September	57,888	207,817	.....	.....	233,066	297,716	.....	.....
October	67,639	230,668	.....	.....	221,274	321,777	.....	.....
November	79,869	257,476	.....	.....	141,485	190,419	.....	.....
December	62,099	226,960	.....	.....	156,609	209,205	.....	.....
	816,829	$2,776,765	.....	.....	2,049,723	$2,949,371	.....	.....

Domestic hydraulic cement shipped to Alaska, Hawaii, and Porto Rico, in March, 1928

	Barrels	Value
Alaska	1,296	$ 3,967
Hawaii	23,825	54,654
Porto Rico	2,595	5,845
	27,716	$64,466

Production and stocks of clinker (unground cement). by districts, in April, 1927 and 1928 (in thousands of barrels)

District—	Production		Stocks at end of mo.	
	1927	1928	1927	1928
Eastern Pa., N. J., and Md.	3,452	3,067	1,996	1,974
†New York and Maine	895	924	580	1,125
Ohio, Western Pa., & W. Va.	1,423	1,411	1,634	1,998
Michigan	1,133	1,048	1,850	1,881
Wis., Ill., Ind. & Ky.	1,710	1,491	1,944	2,515
Va., Tenn., Ala., Ga., Fla. & La.	1,416	1,397	897	1,029
Eastern Mo., Ia., Minn., & S. Dak.	979	1,198	942	1,162
Western Mo., Nebr., Kans., & Okla.	947	998	669	657
Texas	476	556	138	159
Colo., Mont., & Utah	193	206	846	447
California	1,262	1,187	1,233	1,349
Oreg. & Wash.	360	361	606	682
	14,246	13,844	13,335	14,978

Production and stocks of clinker, by months, in 1927 and 1928, in thousands of barrels

Month	Production		Stock end of month		Month	Production		Stock end of month	
	1927	1928	1927	1928		1927	1928	1927	1928
Jan.	10,410	*11,839	9,989	9,672	July	15,697	.....	9,609	.....
Feb.	9,253	11,363	11,943	12,237	Aug.	16,396	.....	7,887	.....
Mar.	12,397	12,501	12,997	*14,463	Sept.	15,931	.....	6,490	.....
Apr.	14,246	13,844	13,335	14,978	Oct.	16,469	.....	5,960	.....
May	15,677	.....	12,514	.....	Nov.	14,698	.....	6,374	.....
June	15,437	.....	10,926	.....	Dec.	13,177	.....	*7,660	.....

*Revised.
†Maine began producing and shipping in April, 1928.

Hydraulic Cements In 1927

Statistics of hydraulic cements, other than Portland cement, in 1927, which include masonry, natural, and puzzolan cements, as compiled by the United States Bureau of Mines, Department of Commerce, show that the nation's production—2,123,868 barrels—exceeded that of 1926 by about 1 per cent. Shipments of these cements from mills in 1927 increased over 6 per cent in quantity and over 2 per cent in gross value. Stocks at the mills decreased and were about 19 per cent lower at the end of 1927 than at the end of 1926.

These statistics represent the output of 11 plants, which are located as follows: One each in Alabama, Illinois, Indiana, Kansas, Kentucky, Ohio, and Pennsylvania; and two each in Minnesota and New York.

The output has been expressed in terms of 376-pound barrels to correspond with the statistics of Portland cement.

Masonry, Natural, and Puzzolan Cements Produced, Shipped, and in Stock in the United States, 1926 and 1927

Year	Active Plants	Production Barrels	Shipments Barrels	Shipments Value	Stock (Dec. 31) Barrels
1926	11	2,104,891	2,031,851	$2,820,110	181,928
1927	11	2,123,868	2,158,323	2,881,029	147,473

Graphite in 1927

While the total production of graphite in the United States in 1927 was slightly less than that of 1926, its total value increased according to a statement by the United States Bureau of Mines, Department of Commerce. The following statistics of production were collected in cooperation with the geological surveys of Alabama, Michigan, and Texas. The sales of natural graphite by producers in 1927 were 5,207 short tons, valued at $232,971, a decrease of 263 tons, or 5 per cent, in quantity, and an increase of $13,629, or 6 per cent, in value, compared with 1926. The decrease in production was in the amorphous variety, the crystalline variety increasing both in quantity and value. The sales of amorphous and crystalline graphite were nearly equally divided, 2,595 tons of the former and 2,612 tons of the latter being sold or consumed by the producer. This was a decrease of 380 tons, or 13 per cent, in the former and an increase of 235,200 pounds (117 short tons) or 5 per cent in the latter. The value of the amorphous variety decreased $4,650, or 11 per cent, and the crystalline variety increased in value $18,279, or 10 per cent, compared with 1926. The quantity and value of crystalline graphite in 1927 were the largest since 1920.

The producing States in 1927 were Alabama, California, Michigan, Montana, Nevada, Rhode Island, and Texas. Alabama is the leading State in the production of crystalline graphite and reported 66 per cent of the total quantity and 74 per cent of the total value in 1927.

The striking features of the industry, in 1927, were the activity in Alabama, the increased production of crystalline graphite there, and the reappearance of California as a producing state after five years of inactivity.

The manufacture of artificial graphite in New York decreased considerably, from 21,163,986 pounds in 1926, to 12,257,239 in 1927, or 42 per cent.

The imports of graphite in 1927 amounted to 17,452 short tons, valued at $723,923, compared with 16,166 short tons, valued at $921,233 in 1926, an increase of 8 per cent in quantity, but a decrease of 21 per cent in value.

Natural Sodium Compounds and Borates in 1927

The production of sodium compounds, not including common salt, from natural salines and brines in this country in 1927, as indicated by sales or shipments by producers, amounted to 145,770 short tons, valued at $3,834,324, according to the United States Bureau of Mines, Department of Commerce. These figures include the output of sodium carbonate (soda ash), sodium bicarbonate, sodium sulphate (salt cake and Glauber's salt), trona, and sodium borate (borax and kernite), and show a large increase in both quantity and value as compared with 1926 partly on account of the recent development of kernite deposits.

The sodium carbonates reported were all from California and amounted to 67,240 short tons, valued at $1,253,352. They were produced from Owens Lake, Inyo County, by The Clark Chemical Co., Lone Pine (soda ash); the Inyo Chemical Co., Lone Pine (soda ash, sodium bicarbonate, and trona); and the Natural Soda Products Co., Keeler (soda ash, sodium bicarbonate, and trona); and from Searles Lake, San Bernardino County, by the Westend Chemical Co., Westend (sodium bicarbonate).

The sales of sodium sulphate amounted to 23,080 tons, valued at $168,882. Sodium sulphate (salt cake) was produced at Clarkdale (P. O. Camp Verde), Yavapai County, Arizona, by the Sodium Products Corp.; at Wabuska, Lyon County, Nevada, by the American Sodium Co.; and at Monse, Okanogan County, Washington, by the Naso Chemical Co. Hydrated sodium sulphate (Glauber's salt) was produced at Casper, Laramie County, Wyoming, by D. W. Gill.

Sodium borate, as borax, was produced from Searles Lake brines in San Bernardino County, California, by the American Potash & Chemical Co. at Trona; and by the Burnham Chemical Co. and Westend Chemical Co. at Westend. Sodium borate, as "kernite," was mined by the Pacific Coast Borax Co. from the Baker deposit, Kern County, near Barstow, Calif.

Colemanite (calcium borate) was mined at the Ryan Mines, Death Valley Junction, Calif., by the Pacific Coast Borax Co., at the Gerstley plant, Shoshone, Calif., by C. M. Rasor, and at the Anniversary mine, Las Vegas, Nevada, by the Westend Chemical Co. The total boron minerals shipped in 1927 amounted to 109,080 tons valued at $3,473,399.

A Many Purpose Material

Sisalkraft, a many purpose material, has recently been announced. This material is made of two layers of heavy kraft paper reinforced with two layers of sisalhemp fibers which run crosswise in both directions between the paper layers. In addition to the sisal reinforcing, the product is made waterproof and tougher by two layers of heavy asphaltum. All the materials are pressed together, while hot, under heavy pressure.

Sisalkraft, which was first considered a common building paper, is now used by contractors to protect supplies from exposure and lessen deterioration; for building temporary sheds for housing employes; and to protect small residences from dust and excessive moisture. The chief characteristics are its low cost water proofing advantages; its strength which makes it available for many purposes; and the saving of labor in its application.

Cement Products Rebuilding

The Cement Products Company of Renton, Washington, is erecting a 60 by 90 foot building to replace the structure recently destroyed by fire. On the top floor, which is 92 by 110 feet, a driveway is being constructed, making it possible for trucks loaded with sand, gravel or cement to drive the length of the building and dump their contents into the bins. Manager L. S. Show announces that shower baths will also be installed.

Karch Company Purchases Sand and Gravel Pit

The John Karch Company of Celina, Ohio, which has a quarry and crusher south west of Celina and one west of Jay City, Indiana, has purchased the Smith and Baker Pit at New Corydon. This is intended to give the Karch Company a large output of sand and gravel to combine with its trade in the crushed stone field.

Fire Destroys Plant

The limestone crushing plant of the Basic Products Company, Columbus, Ohio was destroyed by fire May 7th. The damage, which is estimated at $100,000, was mostly covered by insurance, according to reports.

Sand and Gravel Pit Opened

The pump of the new sand and gravel pit of the Affolder Brothers, near Berne, Indiana, was started May 3. A large pit has been excavated on the Charles Sullivan farm and the necesary equipment for pumping, washing and refining has been installed.

Concrete Products Meeting

The semi annual meeting of the Northwest Concrete Products Association was held in the Olympian Hotel, Olympia, Washington, April 23. Most of the day was spent in discussing specifications for culvert pipe which is the main product of the members.

New Indiana Plant

The Brazil Sand and Gravel Company is installing machinery for taking gravel from Eel River just south of Poland Bridge, Indiana. The plant, construction of which is being superintended by Charles Murphy, will produce graded gravel for road and construction work. This firm also operates a pit on the Hill estate west of Brazil.

Riverside Cement Organized

The Riverside Cement Company has recently been organized to acquire all the holdings of the Riverside Portland Cement Company of Riverside, California. The permit, as granted by the State Corporation Department, authorizes the new Riverside Cement Company to issue to the Riverside Portland Cement Company 60,000 shares of the first preferred stock, 240,000 shares of its class A common and 240,000 shares of its class B common. The total authorized capitalization of the new company is 700,000 shares of no par value and the officers are N. L. Cummens, Jr., president; William H. Metcalf, secretary; and additional directors are Thomas D. Henshaw, William Donaldson, Charles C. Keeney, Thomas W. Russ, M. E. Jones, Stephen R. Duhring, and G. Delsuc.

Hubbell Sand Purchases Manistee Sand Dunes

The Hubbell Sand Company of Manistee, Michigan, has purchased the picturesque sand dunes which guard the gateway to the city. The company owns and is operating on dunes to the north of the city and proposes, according to an announcement, to build docks and install equipment at a cost of not less than $100,000 to remove the dunes, during 25 years.

Milwaukee Company Enlarges

The Cincrete Company of Milwaukee, Wisconsin, has acquired the Cincrete Products company and proposes to enlarge the capacity of the plants. It manufactures building materials of pulverized cinders and cement.

Jamestown Purchases Quarry

Jamestown, Rhode Island, has purchased several acres of stone land from Charles R. Maxfield and Elizabeth Gladding. It proposes to establish a stone quarry in connection with the road building program and has appointed A. A. Boone, Charles Gardner, Alton Head and Charles A. Brooks to investigate sources of machinery and supplies for the development.

Engine Backfire Causes Loss at Gravel Plant

Fire caused by the backfire of a small gasoline engine on a barge of the Blue River Sand and Gravel Company near Blue Rapids, Kansas, caused a loss of approximately $18,000. The barge supported a large diesel engine for operating a sand pump, and the small engine, suspected of causing the fire, was used for pumping air to start the large engine. The daily production of the plant was 24 cars of refined sand and gravel per day. The principal owners of the company are A. A. Marvin, Frank Marvin, C. E. Cummings, F. A. Train and Alva Stryker of Blue Rapids.

Alpha Purchases Phoenix

The Alpha Portland Cement Company, G. S. Brown, president, announces that it has purchased and taken over the plant, business and good will of the Phoenix Portland Cement Corporation, Birmingham, Alabama. The plant has been designated the Morton plant of the Alpha system. Lindley C. Morton, president, and R. J. Hawn, vice president, of the Phoenix are retiring from the cement industry to care for other interests, but the personnel of the plant will remain as heretofore. S. C. McCurdy is in charge of sales for the Morton plant as Southern sales manager of the Alpha Portland Cement Company.

Pownal to Have Large Cement Plant

A company, known as the Commonwealth Portland Cement Corporation, is being formed to erect a cement plant at Pownal, Vermont. The raw materials will be taken from the land near the Pownal lime kiln and the plant to manufacture cement will cost in excess of $750,000, according to announcement credited to Leonard L. Griffiths of Ann Arbor, who is heading the new concern.

Greenville Changes Name

The name of the Greenville Gravel Company of Greenville, Ohio, which was organized in 1904, has been changed to the American Aggregates Corporation. The directors are F. D. Coppock, C. E. Patty, Guy C. Baker, H. R. Brown, Joe F. Coppock, J. E. Patty, W. S. Meeker, D. L. Gaskill and Adelbert Martz.

Kentucky Stone Merger

Seven Kentucky stone crushing concerns have merged to form the Consolidated Stone Company, incorporated at $9,000,000, H. A. Hoffman, president of the new group, announced recently. The member companies produce 85 per cent of all crushed stone quarried in Kentucky.

Kelso Gets Plant

George Weber and Son of Kelso, Wyoming, has purchased a site on the Cowlitz River and has taken out a permit for the construction of sand and gravel bunkers. The plans also call for the construction of a dock, according to a statement of George Weber, president of the company.

Quarry Reopened

The France Stone Company is planning to reopen its quarry at Willshire. The quarry has been shut down for some time and the necessary adjustments are being made and some equipment is being moved from Bluffton, Indiana.

NEWS OF EQUIPMENT MANUFACTURERS

Lime Kilns and Hydrators

A 20 page illustrated booklet distributed by Arnold and Weigel, contractors and engineers, Woodville, Ohio, describes the products designed and manufactured by them.

The Arnold lime kiln is a steel shell 11 feet in diameter by 29½ feet high if a unit, or 24½ feet if part of a battery, and an 8 foot cooling chamber. The draw shears under the cooler may be of the swinging, hand operated, or the pneumatically controlled type. The McGinty grates combine the sifting, shaking and dumping styles and are provided with dumping levers. The kiln lining is of 9 inch standard fire brick and the supports are made of steel, arched concrete or solid concrete. The kiln will hold 70 tons of stone or 35 tons of lime and the cooling chamber 12 tons of lime.

The Weber lime hydrator will handle from 4 to 6 batches an hour and has an overall length of 14 feet 2½ inches, width of 4 feet 1 inch, and height, without stack, of 10 feet 3 inches. This machine automatically maintains the proper water-lime ratio once it is determined for any given lime.

The Word electric drive coal feeder, or stoker, is driven by a ½ horse power motor connected to a speed reducer and will fit any external fire box kiln. Coal from 2½ inches down to dust can be fed in amounts varying from 500 pounds to 30 tons in 24 hours. Arnold and Weigel operate an experimental lime plant where tests are made to develop and increase the efficiency of their products.

A New Air Compressor Developed

The Ingersoll-Rand Company, 11 Broadway, New York, has added a new portable air compressor to its line. This new size has a 4¾-inch bore and 4-inch stroke and a piston displacement of 82 cubic feet per minute. It is equipped with a four-cylinder, tractor type Waukesha motor with Ricardo head and is available on broad faced steel wheels, steel wheels with rubber tires, trailer mounting, Ford or Chevrolet truck, or without running gear for mounting on skids, railway cars, etc. This model also embodies all of the features found in other Ingersoll-Rand portable compressors such as the rigid cast-steel frame and the automatic compression regulator.

Automatic Brake Permits Push Button Control

The General Electric Company announces an automatic brake for use with its super-synchronous motors, which eliminates the necessity for manual braking of the rotating stator by which the desirable features of hand braking are retained. The mechanism consists of an upright standard which supports a threaded vertical shaft. When revolving, it transmits motion to a series of levers attached to the brake band. The driving motor for the brake is mounted on the side of the standard and is geared to the screw shaft. A wheel is mounted on the end of the shaft so that it may be operated by hand. When the brake is being released, the trunnion block travels upward on the screw and is stopped by the tripping of a limit switch when sufficient clearance has been obtained between the brake band and the motor frame. In tightening the brake, the trunnion block moves down on the screw, automatically applying tension to the brake band through the combination of levers and weights until the action is stopped by a limit switch. By adjusting these weights it is possible to vary the starting time of the motor over a reasonable period.

The balancing of the weight and the closing of the band around the frame take place gradually. Over two seconds elapse after the band makes contact with the frame before full tension is established which does not include the time taken to remove the slack from the band. The tension is applied at the same speed, regardless of the amount of weight on the lever. The two-second interval allows ample time for the application of torque to the load and still is not long enough to make the equipment sluggish when used to spot or jog the driven machine.

New Hockensmith Car

The Hockensmith Wheel and Mine Car Company is distributing an illustrated folder describing the new Hockensmith Westinghouse 4 wheel air brake car and several types of Timken roller bearing pulleys. The car is 16 feet long, 6 feet 6 inches wide, with a height off the rail of 60 inches and has a water level capacity of 320 cubic feet. Principal features are, roller bearing wheels, separate hand operated brakes, and generally simplified construction.

Primary Resistance Switches

The General Electric Company has announced a new line of primary resistance drum switches for use with squirrel-cage induction motors on small cranes, hoists and machine tools, bearing the designation CR-3200-1250. It is made in two forms: CR-3200-1250-B for hoists with spur gearing and no automatic mechanical load brake, and CR-3200-1250-A for hoists using low efficiency worm gearing or an automatic mechanical load brake. The switches are built without operating mechanism so that the user may select the type of operating equipment he desires. The dial plate for the horizontal handle is assembled with the drum switch and it is removed and discarded when the vertical handle or rope wheel attachment is to be used. This change in operating mechanism involves the removing and replacing of four screws from the dial plate.

Worthington Moves Offices

The Worthington Pump and Machinery Corporation announces that its executive, purchasing, traffic and accounting departments together with New York District sales and export sales offices are located at 2 Park Avenue, New York City. The general sales and advertising offices are located at 421 Worthington Avenue, Harrison, New Jersey.

Grant Joins Foote

Kenneth Grant, formerly with the Machinists Supply has joined the sales organization of the Foote Brothers Gear and Machine Company. His headquarters, for the present, are in the general offices of the company and he is covering territory in southern Wisconsin, northern Illinois and eastern Iowa.

Griffin Joins Chain Belt

Howard J. Griffin, formerly sales manager for the Spencer Construction Company and for a number of years with Allis Chalmers Manufacturing Company in the East, has joined the sales organization of the Chain Belt Company. Mr. Griffin will be connected with the chain and engineering division which includes the belt conveyor line, manufactured at Cleveland, recently acquired from the Stearns Conveyor Company.

A Swing Hammer Crusher

The Bonnot Company of Canton, Ohio, is distributing its illustrated bulletin number 75 describing the line of swing hammer crushers of its manufacture. These crushers are made in four sizes: the 20 inch series which will reduce 2 to 3 inch material, the 30 inch for 4 to 5 inch material, the 42 inch for 8 to 10 inch material, and the 50 inch for 12 to 18 inch material. The 20 inch series can also be used as a pulverizer at high speeds.

The construction is largely of steel, the housing being steel plate securely riveted and reinforced with structural steel. The shafts are of heat treated special steel, and the cage is made of either special cast steel manganese, or heat treated bar steel, which can be had with spacings of 1-16 inch to 4 inches. A stray iron compartment is provided for removing stray iron from the crusher with a cleanout door for easy access. Bearings are oversize and the breaker plate is adjustable and faced with renewable special or manganese steel. In the small and medium sizes hammers are made of heat treated alloy steel while manganese is used in the larger sizes.

Central Track Equipment

The Central Frog and Switch Company of Cincinnati, Ohio, is distributing an illustrated circular describing the various kinds of track equipment it designs and manufactures for use in mines and quarries. Among these are curved turnouts with long arm frogs, diamond turnouts with extension points, turnouts with rigid switch points for plants using mule haulage, guard rail clamps, rail braces, split switches switch stands, crossings and crossovers, extension points and several types of parallel throw switch stands. Riveted plate frogs, and steel ties furnished with patented forged clips, as well as gauge track braces to hold the track to gauge on curves, at switches, and at places where the roadbed is not solid are also manufactured. All of the above mentioned articles are made for any gauge of track.

Rotary Driers Discussed

Harmor and Company of 906 Walbridge Building, Buffalo, New York, is distributing an illustrated circular describing the Harmor rotary dryer for agricultural limestone, general stone, silica sand, Fullers earth and other similar materials. The outer shell has flanges which lift the material being dried and cascade it on to a central heating tube which rotates with the shell and in which the products of combustion are confined. The heat range of this tube is from warm to red hot and specially shaped longitudinal flanges keep the material in its travel directly in contact with the hot surface. Special spring suspension of the heating tube compensates for expansion and contraction. Heating is by gas or oil and the exhaust passes directly into a separate exhaust chamber for ready discharge to any flue connection. If desired a deflector can be installed at the discharge end to return the heat through the drying chamber, giving direct as well as indirect heat. A special type of housing for handling fine materials to any standard type of dust arrestor, or a screening section, can be attached to the discharge end. Dust proof ball bearings are used throughout and the drive is a direct connected, enclosed, gear reduced unit, or chain to sprocket on shell, as desired. No fire box or stack is required, and mounting can be made on any floor of a factory building. These dryers are made in all sizes, large and small and with portable stands as regular equipment on the 22, 24, 30 and 36 inch sizes, and in larger sizes ready to mount on footings.

Manganese Moves Offices

Manganese Steel Forge Company, manufacturers of Rol-Man Manganese Steel Screens and various products fabricated or forged of rolled manganese steel, announce the removal of their Chicago office from the Old Colony Bldg., to the Builders Building, La Salle Street and Wacker Drive, Chicago. W. H. Potter is in charge of this office.

Coffin Tablet Unveiled

In the presence of more than 10,000 employes, the board of directors and a few invited guests, a bronze tablet honoring the memory of Charles A. Coffin, founder of the General Electric Company, was unveiled May 8 at the Schenectady plant by Miss Alice Coffin, daughter of the late Mr. Coffin. Ceremonies were arranged for the unveiling, including an address by E. W. Rice, Jr., honorary chairman of the General Electric board. The fund which made the tablet possible was established 25 years ago by General Electric employes.

Wire Rope Pointers

The A. Leschen and Sons Rope Company of St. Louis, Missouri, is distributing a 30 page illustrated booklet entitled "Practical Information on the Use and Care of Wire Rope." In this booklet much useful information is given on the unloading, breaking in, and storage of wire rope, as well as warnings against misuse, such as the application of sudden stresses, kinking, excessive speed, reverse bending, misalignment of pulleys, and undue wear caused by the use of pulleys and sheaves of too small a diameter. Included are detailed descriptions telling how to cut and bind the ends of wire rope, how to make splices in both round and flat strand ropes, how to apply clips and sockets, and correct methods of reeving tackle blocks with one or more sheaves. Tables are also presented telling the number of clips and amount of spacing required to safely attach thimbles, how to find rope stress and deflection on cableway spans, how to calculate the stress in guy ropes and in haulage ropes used to draw a load up an incline, how to find the rope capacity of a drum, and a number of suggestions on measuring and ordering wire rope.

Morrison Supply Acquires Track Material Business

The Morrison Railway Supply Corporation has purchased the railway track material business which has been conducted by Morrison and Risman for over 40 years. Morrison Railway Supply Corporation operates plants and warehouses in Chicago, Indianapolis and Pittsburgh.

Ohio Power Shovel Opens Several New Offices

The Ohio Power Shovel Company announces the opening of several offices and the representatives in charge of the different districts. An office has been established at 30 Church Street, New York City, with L. H. Morris in charge; another at 1119 South 56th Street, Philadelphia, with E. E. Fort as manager; and H. P. Steinbrenner is in charge of the office in room 1250 Strauss Building, Chicago.

Bayley Promotes Employes

Bayley Blower Company has announced the promotion of Charles H. Jackson to the position of general sales engineer and the appointment of Ernest Szekely, chief engineer. Mr. Szekely is a graduate of the University of Budapest where he was asociate professor of mechinical and electrical engineering; research engineer for the American Blower Company; chief engineer for the Drying Systems and later a Consulting Engineer in Cleveland, Ohio.

Egypt Honors Ewart's Memory

In the presence of representatives of King Fuad and cabinet members, Mrs. Ruth Litt of New York recently unveiled a tablet in Cairo, Egypt, in memory of the late William Dana Ewart, inventor of the link-belt chain and founder of the Link-Belt Company. The occasion was the presentation of Ewart Memorial Hall to the American university in Cairo in behalf of Mrs. Orville Davies, granddaughter of Ewart, who was the donor of the building. The ceremonies were attended by a brilliant assemblage, including various ministers, members of the Egyptian parliament, representatives of the British high commissioner in Egypt and prominent Americans.

The corner stone of the building, which is known as the Ewart Memorial Hall, was laid in February, 1927, and was completed in March, 1928, costing $150,000, of which $100,000 was given by Mrs. Davies. The structure contains an auditorium, sixteen classrooms, a small chapel, four apartments for faculty members, five office rooms and an exhibition room.

Hans J. Meyer to Represent International Combustion

Announcement is made of the appointment of Hans J. Meyer as an engineer of the Foreign Department of nternational Combustion Engineering Corporation, who will sail on June 6 for the Far East. His early training was with The Milwaukee Electric Railway and Light Company and later as district engineer, Allis Chalmers Company; sales engineer, Westinghouse Electric and Manufacturing Company; superintendent, Shreveport Gas, Electric Light and Power Company; and partner in the consulting engineering firm of Vaughn, Meyer and Sweet.

Heat Insulating Materials

The Celite Products Company, with offices in principal cities, is distributing a 16 page illustrated booklet describing Sil-O-Cel insulating materials. These materials are produced from the mineral Celite, which is an extremely pure and light weight form of amorphous silica, and are made in forms and grades to meet temperature and structural requirements of insulating service ranging from low temperatures to as high as 2,500 degrees Fahrenheit direct heat. It is made in the forms of brick, block, powder and cement, and in a calcined granular form for use as an insulating packing or as an aggregate with portland cement in the making of insulating concrete. A high temperature cement for bonding and facing fire brick walls, and an elastic adhesive material for air-sealing and waterproofing exposed brick or cement surfaces are also made. It is claimed that they weigh less than half as much and conduct less than one third as much heat as fire brick. Crushing strengths vary from 350 to 550 pounds per square inch except in the granular form where strengths of over 1,000 pounds per square inch can be obtained by mixing with portland cement to form concrete, in which case however some of the insulating properties are lost. The chief uses of these products are lining and filling in walls, roofs and floors of kilns, fire boxes, flues and any other places where heat insulation is desired.

A Safety Gear Winch

The Weller Manufacturing Company has recently developed a safety worm gear winch, which is said to be especially adapted to conditions where it is necessary to raise and lower materials. The hoist has a self locking feature which makes it safe and holds the drum in position when the operator releases the handle. The worm is hardened ground steel and is protected by a cast iron guard. The gear and frame are of cast iron and the frame is bored for the shafts. The crank is of cast steel, extra long to give sufficient leverage.

The Western Tumblebug

A practical scraper of one cubic yard capacity that will handle all kinds of dirt, which is simply constructed, has recently been perfected. It has no drive chains, clutches or sprockets and may be dumped from the ground. One man can dump any number, one at a time either from the ground or his stand on the machine. The Western Tumblebug claims all the advantages of a wheel scraper with none of its disadvantages.

Centrifugal Pumps

The De Laval Steam Turbine Company of Trenton, New Jersey, in its 72 page illustrated Catalog B describes the De Laval single and multistage centrifugal pumps, double helical speed reducing gears, and geared turbine driven pumping units. A large number of illustrations showing these installations in use as well as a number of tables and pump characteristic curves are shown.

The features common to these pumps are: two piece casing split horizontally in the plane of the axis of the shaft, giving access to all internal parts; the bronze impeller of either the enclosed double suction or the open type according to the kind of material to be pumped; the labyrinth wearing rings; and the hammer forged, open hearth steel shaft completely protected by bronze sleeves. The vertical pumps are of practically the same construction except that a marine or ball-type thrust bearing is added to carry the weight of the revolving parts. Any form of power, such as a gasoline or oil engine, electric motor, steam turbine or pulley, can be applied either directly or through the double helical speed reducer.

Wise Moves Offices

Royal C. Wise, who represents the American Air Compressor Works, The Erie Pump and Engine Works, the Wagener Steam Pump Company and the Frank J. Kimball Company has moved his offices to suite 816, Oxford Building, at 118 North La Salle Street, Chicago, Illinois. Mr. Wise was formerly located in room 1642 Monadnock Block at 53 West Jackson Street.

Rollway Makes Appointment

The Rollway Bearing Company, Inc., has appointed Alfred E. Munch as representative in the Chicago-Milwaukee District. His offices will be in suite 544, Railway Exchange Building, Chicago, with telephone, Wabash 8169.

Seal Rings Discussed

The Huron Industries, Incorporated, Alpena, Michigan, is distributing a 20 page illustrated catalog describing Huron seal rings for rotary kilns and rotary dryers. It is stated that the design is based on the gravity principle which has never been employed for equipment of this kind. These rings were designed to continuously seal the kiln from the outside air and thus effect an economy of coal or gas and waste heat for power production. The principal features are, the wall plate is designed in halves, so that it may be attached after the kiln is installed, and is bolted to the furnace wall through anchor bolts, inserted in the concrete or masonry; the seal ring is also designed in halves and is mounted on the outside of the wall plate; roller bearings carry the trolley back and forth in a slot on the bracket; the bracket is bolted to the furnace wall and acts as a guide for the seal ring; and the joint ring, which is split in halves, is bolted to the kiln on an angle iron which is fastened to the kiln. Installations are readily made on operating plants without dismantling or tearing down.

New Portable A. C. Instruments

The Westinghouse Electric and Manufacturing Company announces a new line of portable alternating current instruments designated as type PY5 which are of the direct reading type and applicable for general testing and laboratory work where high accuracy is required. The voltmeters and single phase wattmeters are of the electrodynometer type. The ammeters are of the moving iron type, using vanes of non residual metal. All instruments are shielded and damped by an air damper. The voltmeters have an accuracy of ¼ per cent and can be used without appreciable error on direct current or alternating current to 133 cycles. They are provided with a push button for closing the circuit which can be locked in the closed position.

The ammeters have a double range which can be changed while the meter is in use by a series parallel switch mounted in the case. The movements are mechanically strong and will successfully stand high momentary overloads and may be used on circuits up to 500 cycles and on direct current with but slight reduction in accuracy. The single phase wattmeters have an accuracy of ¼ per cent and may be used on circuits up to 400 cycles without requiring correction for phase displacement. The current circuits are double range with series parallel arrangement of coils, and are controlled by a switch inside the instrument operated by a knob in a recess.

A New Six Cylinder Engine

The Continental Motors Corporation of Detroit has placed in production a series of six-cylinder overhead valve engines, intended exclusively for bus and truck service, which will be known as the "R" series. The outstanding feature of this series is the overhead valve equipment, which makes possible quick and convenient service. Cylinders are 4⅛ inch bore, and 4¾ inch stroke with a displacement of 381 cubic inches which develops 87 horsepower at 2,400 r.p.m. According to Continental engineers, these engines are marked by smoothness and quietness of operation, extreme durability, economy, accessibility, and long life.

Belt Conveyors for Subways

The use of portable belt conveyors as a tool by Subway Builders is growing in popularity as the Rosoff Subway Construction Company of New York has used four of them at different locations in the city for conveying clay or sand from under the false timber roadway, where no opening is available to excavate the material with cranes or clam shell buckets. In some places it is possible on account of the shallowness of the cut to run the motor trucks directly down to the grade where the belt is conveying the material close to the building lines and where it is impossible to use heavy steam shovels or similar type of equipment. On many other contracts a belt conveyor is used on subway contract for elevating cement in bags from storage room to the concrete mixer.

A New Ten Yard Wagon

A ten yard wagon made of ¼ inch steel plate with the exception of the doors, which are made of $\frac{5}{16}$ inch steel iron, with an extra heavy under-frame is being manufactured by the Biehl Iron Works. Disc wheels are furnished on these large units, and either Hyatt or Timken roller bearings are used. The winding mechanism is operated through reduction gears by a hand lever. All ratchets are counterbalanced and no springs are used. The locking ratchet is operated on the main shaft and load is not carried on reduction gearing while doors are closed. The hitch is built of structural steel, covered over the top with heavy plate and equipped with two inch forged eye bolt with spring draw.

Allis Chalmers Moves Grand Rapids Office

The Allis Chalmers Manufacturing Company, Milwaukee, Wisconsin, announces that the Grand Rapids, Michigan office has been moved to Suite 310, Building and Loan Building. The office, which is a branch of the Detroit area, is in charge of G. C. Culver.

A No-Blind Vibrating Screen

The Deister Concentrator Company of Fort Wayne, Indiana, in a new 12 page illustrated bulletin describes the Leahy no-blind vibrating screen, made in single, double and triple surface styles. It consists of a wire cloth screen held taut in longitudinal tension in a stationary frame by means of tension bolts. A quick return differential vibration is transmitted from the vibrator cam through a connecting rod to a rigid member attached to and extending transversely across the underside of the wire screen cloth, giving uniform vibration at all points in a line across the screen cloth and leaving the sides free to vibrate. The tool steel, 8 toothed cam revolves in oil and gives 1600 vibrations per minute when the vibrator is driven at a speed of 200 revolutions per minute. Standard screening surfaces range from 17 by 32 inches, to 4 by 9 feet, with special sizes built to order, equipped with belt or motor drive, and in both open and enclosed dust-proof types. Wire screen cloth in sizes from 3 inches to 60 mesh can be used and for certain purposes perforated steel plate may be substituted. Standard motor equipment is a General Electric 1 horse power, 3 phase, 60 cycle, 220 or 440 volt electric motor.

Capacity of the 3 by 6 foot 20 mesh screen per hour is claimed to be 6 tons of sand and gravel, 5 tons of rock, 5 tons of ores, and 3 tons of coal; for the 1 inch mesh of the same size, a capacity of 45 tons sand and gravel, 40 tons of rock, 35 tons of ores, and 30 tons of coal per hour is claimed.

Earl D. Stearns Joins Fairfield Engineering

Earl D. Stearns, formerly of the Stearns Conveyor Corporation of Cleveland, Ohio, has become associated with the Fairfield Engineering Company of Marion, Ohio, according to an announcement recently made public by H. B. Walker, president of the company. Mr. Stearns has a record of over twenty years of experience in large conveying and structural engineering work and developed the Stearns anti-friction idler as well as many other engineering features.

H. K. Porter Company Moves Chicago Office

The H. K. Porter Company of Pittsburgh, Pennsylvania, recently moved its Chicago office from Number 447 Monadnock Building to the new Engineering Building, Wells Street and Wacker Drive. George Kirtley, district manager, remains in charge.

New Linde District Office

The Linde Air Products Company has recently opened a district sales office at 48 West McLemore Avenue in Memphis, Tennessee, with H. N. Smith as manager. Users of Linde equipment and supplies in the district will find this office prepared to handle their needs.

Canada Glass Moves Offices

Canada Glass Products, Limited, has moved its offices from the Bank National Building, Rideau Street, to 145½ Sparks Street, Ottawa.

Keystone Well Drillers

The Keystone Driller Company, of Beaver Falls, Pennsylvania, in the 17th edition of its well drillers manual, a 112 page profusely illustrated catalog, gives a complete description of its line of rigs, portable and stationary; gas and steam engines, boilers, cutting and drilling tools, cable, pipes, and other articles necessary to all kinds of drilling. These rigs can be used for many different purposes such as drilling water, oil, and gas wells; boring large blast holes in stone quarries and heavy excavation; mineral prospecting, and placer gold and coal testing; and making soundings for bridge piers and submarine sounding and blasting. An interesting history of ancient and modern wells and well drilling and complete instructions for drilling with modern equipment are included.

The number 3 water well rig with traction and clutch hoist is the most popular of all the Keystone makes. The power plant on this model is a Hercules Model O, 35 horse power, 4 cylinder gasoline engine with a twin disc clutch mounted on the engine flywheel. In addition to operating the drilling apparatus it also furnishes tractive power which is transmitted through reversing and reducing bevel gears to a jack shaft. All shafts are mounted on ball bearings and the whole transmission assembly is enclosed and runs in oil. The reversing transmission applies to both traction and drilling operations and combines with the speed control mechanism in giving flexibility to the drill. Two traction speeds are available, the high speed being 3⅛ miles and the low speed 1¼ miles per hour. It is claimed for this machine that it can be set up without any staking, weighting, blocking or bracing, and that it can operate a heavy string of tools at the rate of 460 three foot strokes per minute. One of the features of this machine is that it can be moved without dismounting or disconnecting anything and under favorable conditions can be set up or taken down in half an hour. All of the levers are grouped at the operator's hand and it is claimed that two men can easily operate the machine at its fullest capacity.

Black and Decker Changes the Sales Personnel

J. C. Goodnight has joined the selling force of the Detroit office of Black and Decker Company, replacing Henry Fox, to specialize in automotive work, and Leon A. Hardy replaces Jack Caffrey in the New York branch as salesman.

Haiss Fordson Loaders

The George Haiss Manufacturing Company, Inc., in an 8 page illustrated circular describes the line of Haiss Fordson bucket loaders and the Traxion chassis.

The Traxion chassis is a creeper traction unit designed to be attached directly to the Fordson tractor. The chassis frame is of 7 inch structural steel channel, and the traction is a heavy duty self-cleaning design with a heavy structural frame carrying a sprocket at the rear, an idler at the front, and a 3 roller support between. Tread plates are heat treated electric steel castings and all bearings are of bronze with Alemite lubrication. Drive is direct from the Fordson rear axle by a roller chain. Steering is done by a steering wheel through Raybestos lined hand brakes and a turn can be made in a 10 foot circle. Speeds are 1.5, 2.7, and 6.8 miles per hour forward, and 2.6 in reverse.

The Model F.C. loader is practically the Traxion chassis with the model 16 loader mounted on it, except that the speeds are 40, 70 and 180 feet per minute forward, and 90 reverse.

The Model F.W.A. loader is similar to the F.C. except that it is wheel mounted with rubber tires optional, and moves into the stock pile in the regular Fordson reverse speed of 2.6 miles per hour.

The Model F.W.B. is also very similar to the above except that it has an extended chassis and an extra axle arranged so that speeds are 26, 48 and 121 feet per minute toward the pile and 47 feet per minute away from it. A patented power box is placed between the Fordson engine and transmission so that the elevator drive take-off is independent of the traction transmission and clutch. All of the above loaders have a capacity of one cubic yard per minute.

Changes Name

The Ingersoll-Rand Drill Company, with offices at 314 North Broadway, New York City, and St. Louis, Missouri, announces that it has been succeeded by Ingersoll-Rand, Incorporated. For the purpose of increasing its service in Northern Oklahoma, Southern Missouri and Arkansas, the company has opened a new branch office at 226 West A. Street, Picher, Oklahoma, which will operate under the St. Louis office.

Waushara Moves Offices

Offices of the Waushara Granite Quarries Company, Badger Crushed Stone Company, DuRo Asphalt Products Company and Thomas P. Flynn will be located in suite 1162-4, 111 West Washington Street, Chicago,

Good Roads Describes

The Good Roads Machinery Company, Incorporated, of Kennett Square, Pennsylvania, in an illustrated circular describes the Good Roads portable gravel crushing and screening plant. The frame is of riveted structural steel, the front axle of built up channels and the rear axle machined and turned steel forgings. Wheels are solid rubber with Timken roller bearings. The loading hopper is of 2 yard capacity with 8 inch bottom grizzly spacing, and the discharge hopper has an under delivery gate with a hand controlled positive shutoff. The screen is of the vibrating type with a 6 foot long and 3 foot wide, ¼ inch steel perforated screen plate, operating at 1000 vibrations per minute and with a capacity of 50 tons per hour. All wearing parts are encased in dustproof housings. The fine reduction crusher has a capacity of 25 tons per hour with jaws set to close at ¾ inch, and a speed of 365 revolutions per minute. The bearings on the eccentric shaft are Timken and S. K. F., the throw of eccentricity is 1¼ inch and the jaw opening 10 by 30 inches. Features are renewable jaws, split hub pulleys and Alemite lubrication. Both the intermediate and loading conveyors are made of 4 inch channel and are equipped with Timken roller bearings. Power is from a 4 cylinder, 50 horse power Waukesha "Ricardo Head" motor with Foote transmission. Capacity of the plant is 50 tons per hour if not over 50 per cent oversize is fed to the crusher.

A New Fordson Shovel and Loader

The Trackson Company of Milwaukee, Wisconsin, manufacturer of Fordson equipment, announces the addition of a line of loaders and shovels. The shovel has a 3½ foot lift, and can be used not only for digging and excavating, but also for backfilling and bulldozing. The loader has a 7 foot lift and a wide range of uses. Both machines have cable tighteners to insure even hoisting of the bucket, multiple disc clutches, anti-friction bearings and an extra long bronze pinion shaft bushing. They are adapted to mounting on either wheel or crawler-equipped Fordsons or on the Trackson Full-Crawler.

Marion Moves Chicago Offices

The Chicago offices of the Marion Steam Shovel Company have been moved from the Monadnock Building to suite 1920 in the McCormick Building.

New G. E. Data

The General Electric Company is distributing several illustrated loose leaf bulletins which are perforated for incorporation into the general catalog of the company. Many of the bulletins are new and original, while others are intended to supersede portions of the catalog.

GEA-233B, "Centrifugal Air Compressors," single stage, presents a brief history of the development of centrifugal air compressors and shows the class of work to which they have been applied. This bulletin deals primarily with the conclusions of three years research work for the purpose of increasing the efficiency of centrifugal compressors. This work has resulted in the redesign of 75 different sizes and greatly improved efficiency. The volume range of these compressors is from 250 to 75,000 cubic feet per minute and can be built for pressures as low as one pound.

GEA-308A, "Air Suppressor Plates" for drum controllers, supersedes GEA-308. These plates are especially designed for the older types of controllers which were not provided with suppressor plates. This bulletin includes catalog numbers of complete arc deflectors and individual arc suppressor plates for various controllers, together with their location and number.

GEA-752, "Direct Current Motors," type BD, supersedes 61015 and, in part, GEA-223. These are made with constant speed in sizes of ½ to 3 h.p., either shunt or compound wound and in adjustable speed, shunt wound from ½ to 1.

GEA-835A, "DC Magnetic Controllers" for constant and adjustable speed motors gives the salient features as, definite time acceleration; hand reset temperature overload relay which safeguards motor and machinery; compactness; line and accelerating contacts are interchangeable for all sizes; and an attractive appearance.

GEA-894A, "Adjustable Speed d.c. Motors," type CD supersedes, in part, GEA-223. Type CD adjustable speed motors are said to be applicable to a wide variety of tools or machines where constant horsepower or constant torque is required within the working speed range.

GEA-934, "CR7896 Automatic Throw Over Panels" are designed for emergency lighting systems in motion picture houses, theaters, schools, offices, public buildings, hospitals and operating rooms. In case of an interruption of the lighting system, the automatic throw over panel transfers the load to the other source of power which is used in emergencies.

GEA-948, "CR4065 d.c. Magnetic Controllers" are designed for constant speed motors. The salient features are, definite time of acceleration assuring specified accelerating period, regardless of load conditions, multifinger contactor provides ample accelerating points; line and accelerating contact are interchangeable for all sizes and, an attractive appearance.

GEA-950, old series 68355, "CR1028 a.c. Enclosed Starting Rheostats," is a small, inexpensive starting device, designed for starting slip ring induction motors which do not require more than a full load torque to start or longer than 15 seconds to attain full speed. It is, in principle, a dial starter for use in the secondary circuit of the motor and, therefore requires a separate switch for closing the primary circuit.

Lincoln Changes Personnel

The Lincoln Electric Company has made some changes and additions to its sales and welder services divisions. H. A. Stamper, who is a graduate of Rensselaer and an engineer of considerable experience, has been placed in charge of consumer motor sales and D. F. Titus, a graduate of Penn State and formerly with the Portland Cement Association, is now in charge of welder service, under the direction of G. N. Gull, New York manager. A. H. Kirkpatrick replaces D. W. Carver, who goes to Cleveland, as manager of welder service in the Cincinnati district. H. E. Nelson, formerly with Willys Overland, is in charge of consumer motor sales in Cincinnati. P. A. Ludwig, who is in charge of welder service in Philadelphia, was formerly with Welding Engineers, Incorporated. Forest Kessler has been transferred from the welding time study department to welder service division in Cleveland. J. R. Rothermel is in charge of welder service at Chicago under R. D. Malm, while W. Weaver has been placed in charge of consumer motor sales in the same district.

A New Loader Discussed

The George Haiss Manufacturing Company is distributing a 32 page illustrated bulletin describing its new Model 27 creeper tread, path digging loader, the attachments with which it can be equipped, and the various types of work for which it can be used. It also presents a number of tables comparing the cost of handling materials with this loader with those of other methods, and several diagrams for calculating the number of trucks required to move any definite yardage for various miles of haul.

The power plant consists of a 41 horsepower Ricardo head Waukesha motor, complete with magneto, impulse starter, intake air cleaner, automatic manifold heater and gasoline strainer. A 25 horsepower electric motor to suit available current supply can also be furnished. The transmission box houses all clutches, speed change and reduction gears, and the slow speed crowding worm drive, all of which run in oil and are completely protected from dust and grit. The engine drive is triple strand, bushed, roller pin chain. The chassis frame is 7 inch steel channel and the creeper frame and elevator boom are of structural steel. Tread plates are of special electric steel, smooth faced, and are designed to prevent clogging. Bolt holes for grousers are provided. Elevator buckets are seamless, forged from ¼ inch steel plate and are reinforced with a toothed cutting edge riveted to the bucket so it can be replaced when worn out. The feeding device consists of 4 one piece manganese steel propellers which dig a path 2 feet wider than the caterpillar treads.

The fixed discharge spout is standard equipment but a swivel spout or a measuring hopper can be obtained. There are only five controls, the elevator drive, crowding motion, traction speeds, steering, and elevator raising gear, all of which are handled by one operator. This model will load 2 cubic yards per minute, handling any material weighing up to 165 pounds per cubic foot, and which will pass through a 4 inch ring. The forward speed is 96 feet, the reverse 65 feet, and the crowding speed 3 feet per minute.

Columbus Acquires Large Hoist Plant

The Columbus McKinnon Chain Company has recently acquired control of the Hoist Division of Chisholm Moore Manufacturing Company. The general sales offices and factory will remain in Cleveland operating under the original name and the personnel, as a whole, will remain the same. It is believed that this alliance will greatly strengthen the organization and enable it to increase its service to its clientele.

New Zelnicker Bulletin

Walter L. Zelnicker is distributing bulletin 363, listing new and second hand equipment. Among other things listed are cranes, shovels, locomotives, draglines, cableways, cars, engines, pumps, compressors, relaying rails, angle bars and spikes. Zelnicker offers to purchase second hand equipment in any part of the country.

Rates for display advertisements in the Broadcast Section are given below. If you want to buy or sell used equipment, if you want a job or need a man, advertise your wants in Pit and Quarry. Advertisement copy for publication in the next issue should reach our office within one week after the date of this issue.

RATES PER INSERTION	1 Inch	2 Inches	3 Inches	4 Inches	5 Inches	6 Inches	8 Inches	9 Inches	10 Inches	12 Inches	15 Inches	20 Inches	30 Inches
1 Insertion	$8.75	$7.25	$10.75	$14.25	$17.75	$21.25	$28.25	$31.75	$35.25	$42.25	$56.25	$70.25	$105.00
2 Insertions	8.75	7.25	10.70	14.20	17.65	21.15	28.15	31.65	35.15	42.15	56.15	70.00	104.00
3 Insertions	8.75	7.20	10.65	14.15	17.55	21.05	28.05	31.55	35.10	42.05	56.05	69.75	103.00
4 Insertions	8.70	7.15	10.60	14.10	17.45	20.95	27.95	31.45	35.00	41.95	55.90	68.75	101.00
8 Insertions	8.65	7.05	10.50	14.00	17.25	20.75	27.75	31.25	34.80	41.75	55.70	67.50	98.00
13 Insertions	8.60	6.95	10.40	13.90	17.05	20.55	27.55	31.05	34.60	41.55	55.55	66.25	94.00
26 Insertions	8.50	6.75	10.20	13.70	16.65	20.05	27.05	30.65	34.20	41.05	55.05	64.00	88.00

INFORMATION—*"Broadcast"* space is sold by the advertising "inch." Each page contains 30 inches. The width of the page is divided into 3 columns, each 2¼ inches wide. Each column contains 10 inches measured the length of the column. Any space may be used measured by the *even* inch in height (not fractions), by 1, 2 or 3 columns in width. The size of a space is its height in inches multiplied by the number of columns in width. Example: a space 3 inches high by 2 columns wide is 6 inches. Copy changes made without additional charge.

It Pays to Advertise in PIT and QUARRY

"Results were very satisfactory," writes Mr. Chas. E. Thomson, Kansas City, Mo., regarding the returns from his advertisement for crushers and quarry cars.

Complete Service Publishing Company

538 South Clark Street **CHICAGO**

Machinery for Sale

SPECIALS
1—New 8'x125' Allis-Chalmers Rotary Kiln
1—No. 6 Williams Universal Hammer Mill

CRUSHERS

Crushing Rolls

1—8"x5", 1—14"x20", 4—24"x12", 1—26"x15", 1—30"x10", 1—30"x16", 2—36"x16", 1—42"x16", 1—54"x24".

Gyratory

All sizes from No. 2 Reduction to No. 12K.

Jaw

One 4"x8"—two 7"x10"—one 6"x20"—two 9"x15"—one 10"x20"—two 12"x24"—one 18"x36"—one 24"x36"—one 42"x30".

Rotary

Two No. 0, two No. 1, one No. 1½, and one No. 2 Sturtevant Rotary Fine Crushers.

Ring Roll

One No. 1 and one No. 2 Duplex Sturtevant ring roll mills.

Ball and Tube Mills

3', 4', 4½', 5', 5½', 6', 8' Hardinge Mills and Tube Mills.

DRYERS

One 3'x30', Three 4'x30', One 4½'x30', One 5'x40', One 5½'x40', One 6'x60', One 7'x60' and One 8'x80' Direct Heat Rotary Dryers, One 5'x25', one 6'x30', Two 8'x80' Ruggles Coles type "A" and One 4'x20' Ruggles Coles type "B" Double Shell Rotary Dryers.

KILNS

4'x40', 5'x60', 6'x60', 6'x70, 6'x90', 6'x100', 6'x120', 7'x80', 8'x125'.

MILLS

Two 33" and two 42" Fuller Lehigh Mills.
1 No. 0000, 1 No. 00, 2 No. 1, 2—4 Roll, and 1—5 Roll Raymond.
Swing Hammer Mills, Griffin Mills, Attrition and Cage Mills.
Air separators, Screens, Elevators and Conveyors.

The Heineken Engineering Corp.
Industrial Engineers
117 Liberty St., New York City
Courtlandt 5130

LOCOMOTIVE CRANES

1—15-ton Brown Hoist 8-wheel, M. C. B. 46-ft. Boom, 1½-yd. bucket, A.S.M.E. Boiler, strictly first class condition. Price $3500.00 F.O.B. Detroit.

1—15-ton Browning 8-wheel, M.C.B. 40-ft. Boom, 1½-yd. Bucket, A.S.M.E. Boiler, rebuilt, in first class condition. Price $3500.00 F.O.B. Detroit.

LOCOMOTIVES

1—60-ton, 6-wheel standard gauge Switcher, Boiler pressure 180 lb., rebuilt, I.C.C. inspection. Price $5500.00 F.O.B. Detroit.

1—25-ton 12x16 Porter Saddle Tank, standard gauge, A.S.M.E. Boiler, working pressure 160 lbs. Price $3500.00 F. O. B. Detroit.

1—20-ton Montreal Locomotive Works Saddle Tank, standard gauge, located Canada. Price $2,000.00 F.O.B. Cars.

Michigan Equipment Co.
2847 Grand River Ave., Detroit, Mich.
Phone: Glendale 6927

FOR SALE

ROTARY KILNS
2—8'x125'
1—9'x100'
1—7'x120'
2—7'x100'
1—7½'x80'

DRYERS (ROTARY)
1—5'6"x50'
1—5'6"x40'

CRUSHERS (GYRATORY)
1—No. 6 McCully
1—No. 7½ Kennedy
1—No. 9-K Allis-Chalmers

EQUIPMENT SALES COMPANY
R. W. Storrs, Jr., Manager
Richmond, Virginia

CRAWLER SHOVELS

2—ERIE B-2 DREADNAUGHT, Steam Caterpillar, New 1926, 1-Yd. Dippers, HIGH LIFT; Overhauled, Like New.

1—50-B BUCYRUS, Steam Caterpillar; New 1927; 1¾-Yd. Dipper; Used few months; Perfect Condition.

1—OSGOOD HEAVY DUTY (1-Yd.) GASOLINE Caterpillar, 1-Yd. Dipper, HIGH LIFT, Excellent condition.

CRANES

1—NORTHWEST, Model No. 105, Gasoline Caterpillar Crane, New 1926, 40 ft. Boom, Bucket operating, Overhauled, Excellent condition.

2—25-ton, 8-wheel, INDUSTRIAL, Type G, Locomotive Crane, New 1927, 50 ft. booms.

DUMP CARS

25—5-yard, 36 in. gauge WESTERN, two-way side Dump, new 1927; STEEL DRAFT BEAMS; used few months, perfect condition.

GREY STEEL PRODUCTS CO.
111 Broadway New York, N. Y.

FOR SALE OR RENT

DUMP CARS

5—12-yd. Western, Std. Ga., Air. Perfect Condition.

GASOLINE SHOVELS AND CRANES

1—Link-Belt Comb. Gas-Crawler, 1-yd. Shovel and 15-ton, 50 foot boom Crane. Like new.
1—Northwest, Model 105, 50' Boom. 2-yrs-old.

STEAM SHOVELS

1—McMyler ¾-yd. Cat. Steam; also 40' Crane Boom. New 1927.
1—Marion, Model 32, 1¼-yd. Dipper, Full Cat., High Lift, Rebuilt 1927. Perfect shape.

GASOLINE LOCOMOTIVES

2—7-ton Plymouth, 36" Gauge. Like new.
1—8-ton Plymouth, 36" Gauge. Like new.

HOISTING ENGINES

1—40 HP. Mundy, DD, 2-ph., 60-cyc., 220-v.
1—22 HP. Lambert, DD, 2-ph., 60-cyc. 220-v.
1—7x10 Lidgerwood, DC, DD, Boiler mounted with Swinger attached

BOILERS

1—125 HP. Locomotive Type, ASME, 125 lb. Pressure.

TRACTORS

1—10-ton Holt, Gas. Cat.
1—2-ton Holt, Gas. Cat.
1—5-ton Holt, Gas. Cat.

B. M. WEISS
1324 Widener Bldg., Philadelphia, Pa.